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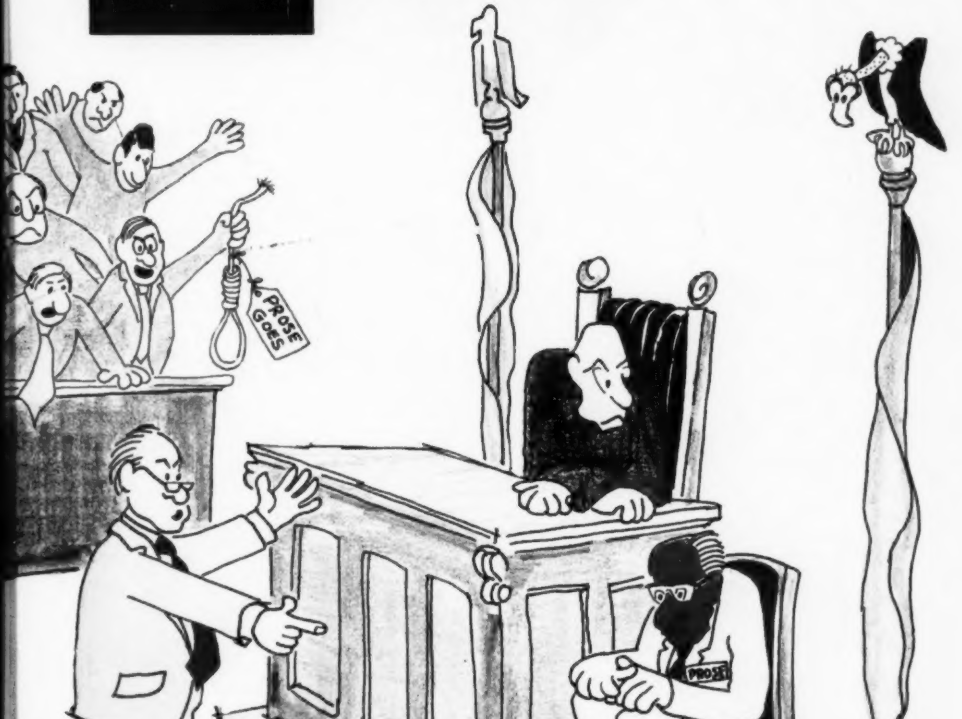
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73 magazine
for radio amateurs

# 158 NOVEMBER 1973

FEATURES

2 Amateur Radio News
4 Never Say Die W2NSD/1
6 SSTV Scene
7 SSTV Contest
8 50 MHz Band
9 Contests
10 Repeater Update
10 Traveling Ham
11 FCC News
12 Looking West
14 AMSAT News
15 QSL Contest
15 Ham Help
15 Intruder Chase
16 DXCC News
17 Hamburglar
17 New Products
98 Letters
108 Caveat Emptor
159 Circuits
159 Phase Lock
160 Ad Index
160 Propagation

CONTENTS

21 Getting Started On 450 MHz K1CLL
Hurry before someone proposes a Class F!
26 Getting Started On ATV WA7NMO
Simple circuits for the beginning ATVer.
35 NI-CAD Battery Life-Saver K2ETN
Insures cold starts.
39 The Heath GR-110 Scanning Receiver W3WTO
A plus for Heath.
49 Is Your Autopatch Legal? W3YVV
Or are you just pretending. . .
53 Frequency Aperture Modulation W2BSP
FAM makes another appearance.
59 VOM Range Extender W2EEY
You can do more than just lengthen the test leads.
63 AC Power Supply for Portable Rigs WA3EEC/1
You can't operate portable 100% of the time!
65 A Radiating Loading Coil W0FEV
An indoor antenna that might pass as a weird lamp.
69 Peak/Notch Audio Filter W6AGX
A worthwhile addition to your rig.
73 Power Failure Protection ....Ives
Make sure brownout doesn't spell burnout.
75 160 Meter Antenna Coupler W2LT
An improper antenna is no longer an excuse for
staying away from 160.
77 HT-100 – 1 Watt, PL and Touchtone K6VGP
Buy your way to happiness.
83 Independent Sideband – SSTV/SSB ......W9NTP & WB8DQT
Narrate your Slow Scan program.
87 The Elusive 100 Countries VE3CEA
This month's tale of International intrigue.
93 Complementary-Pair Audio Amplifier W5SOT
Transistors get lonely too.
103 Amateur Rules and Regulations, Part VI ....FCC
This month the Bounty sets its sails to the south
hoping to find breadfruit.

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Amateur Radio

NOVEMBER MCMLXXIII Monthly Ham

Noting the apparent impossibility of obtaining changes in the repeater rules via normal channels, members of SERCOM (WA3KXF) and the Central Pennsylvania Repeater Association (WA3KZG) arranged a meeting with Congressman Edwin D. Eshleman of the 16th Congressional District of Pennsylvania to explain the situation and appeal for help. Congressman Eshleman was quite receptive and immediately invited correspondence with Chairman Dean Burch of the FCC. Congressman Eshleman did point out that a single Congressman cannot have much affect and as this is a national problem, all interest groups should contact their own Congressional Representatives. The multitude of repeater organizations should easily be able to get Congress working on our behalf.
(photo by WA3MHP)

Saudi Arabia on Slow Scan

Reprinted from the West Coast DX Bulletin.

A couple of stations have been showing up regularly and with 7Z3AB about to be missed, some hope may still exist. HZ1AB has been showing up around 14250 kHz from 1900Z. Says handle is Terry, using Collins gear to a rhombic antenna. . .advised that he will be on most weekends from 1900Z onward and working by districts. HZ1SH has also been showing up regularly in the last month. Gives his name as Fasil and says to QSL to Box 2108, Jeddah, Saudi Arabia. Sometimes in the lower reaches of twenty phone from 1000Z, and sometimes a bit surprising as to what you may hear. Like the following. . .this on SSTV.

W-station: "Please repeat your name and I will send my picture."

HZ1SH: "My name is Fasil. I am the King of Saudi Arabia. Please send your picture."

W-station: "I did not get your name. Did you say you were a king?"

HZ1SH: "Yes. I am the King of Saudi Arabia and my name is Fasil. Please send me your picture."

W-station: "But, I am in my pajamas. I am in my pajamas. Is that okay, King?"

HZ1SH: "Yes. Please go ahead."

W-station: "Okay. . .here it comes. . . . . ."

The point may be obvious but should it not be, if you are on SSTV be prepared!!! You may never know whom you are going to encounter. At least have a presentable photo available for emergencies.

FCC PROBLEMS

An FCC release re the repeater extension mentioned that one of the reasons for the extension was excessive problems with defective amateur repeater station applications.

May I state that from my experience this is directly due to the FCC, not to stupidity on the part of the repeater groups – who are not stupid.

From the outset, 73 Magazine has tried to keep abreast of the rapidly changing Walkerequirements for repeater applications, only to be met with resistance and incommunicativeness. It has been estimated that well over $35,000 has been spent on phone calls to the FCC just on the repeater application situation – and the result has been contradictions and evasions in many cases.

There has been no way to get the information on how to apply for a repeater license and publish it because the ground rules have been ever changing.

Take for instance the situation where Lou McCoy of the ARRL went to Washington, sat down with Walker and got the info on how to work out the height above average terrain (HAAT) calculations – something that appears so simple that even an idiot should be able to manage it, right? This, for some odd reason, was published under a nom-de-plume in QST and plaques and other awards were promptly given this mythical author. Hardly had the ceremonies concluded from all the award giving when Walker decided that this system of calculating HAAT was no longer acceptable.

Surely this is an exaggeration?

Of course the obvious answer is to get rid of the rules which are causing both amateurs and the FCC all the trouble. If the restrictions on antennas, power, crossbanding, tandem repeaters, control and such were removed, then a simple FCC form would suffice and there would be few problems.

News Pages

News of the World **73 MAGAZINE**

GEAR NEEDED

Anything and everything in ham gear is desperately needed by the radio clubs in Jordan. There are presently ten ham clubs there and each has an average of twenty active operators. King Hussein has given each club a rig for starters, but that doesn't scratch the surface. These hams want to operate and to build – and they need gear.

How about taking a good look in your closets, cellar, garage, attics, for workable transmitters, receivers, transceivers, exciters, test equipment, rotors, beams, and usable parts. Can you think of any better use to put these things to than helping new hams in a part of the world where radio parts and equipment just are not available?

By a special arrangement with His Majesty all equipment will be shipped at no charge from the Jordanian Embassy in Washington to Jordan – and there will be no import duty. The address is: Royal Jordanian Radio Amateur Society, c/o Royal Palace, Amman Jordan, via Embassy of Jordan, 2319 Wyoming Avenue NW, Washington DC.

Sideband and CW rigs will be particularly useful – and even VHF rigs will be helpful now that there is a repeater set up in Amman. If there is something wrong with the rig, make a note of it on a tag so they will have a good chance to fix it up over there. But remember that parts are incredibly difficult to get. They take months to arrive when ordered and there are NO radio stores as yet. Please drop a note to 73 and let us know what you've sent. Here is your chance to help out.

CLIPPINGS NEEDED

Please, when you see an article in the paper about amateur radio – clip it out and send it to 73 – or at least a copy of it! We use this material for our news pages – and for letters to congress. We need the material to work with if we are going to do a job for you.

Here is a Who's Who of the Arab Radio Net – just the chaps you'll want to contact to get that coveted Arabian Knights award. Left to right are 7Z3AB, ST2SA, 9K2AL, SU1MA, JY5GQ, JY5AT, JY1, JY4IA, 9K2AM, OD5FJ, JY5KA, JY5AA, OD5FI, JY5AH.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
Technician Class	50.100 – 54.000, 145.000–148.000, 220 MHz band and above.	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
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Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

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Gettysburg PA 17325

RECIPROCAL LICENSING Between U.S. and: CE - CP - CT1 - CX - D - EI - F - G - HB9 - HC - HI - HK - HP - HR - LA - LX - OA - OH - PA - PY - SM - TG - TI - VE - VR2 - VU - YB - YN - YS - YV - ZL - ZP - 3A - 4X - 6Y - 8P - 9K - 9L - 9Y.

THIRD PARTY AGREEMENTS Between U.S. and: CE - CM - CO - CP - CX - EL - HC - HH - HI - HK - HR - JY - LU - OA - PY - TG - TI - VE - VO - XE - XP - YN - YS - YV - ZP - 4X - 4Z - 8R - 9Y. Also W/K/8P.

RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.

. . .de W2NSD/1

EDITORIAL BY WAYNE GREEN

REPORTING OPPORTUNITY

The fine job that the two reporters from the Washington Post did in following up the Watergate questions is proof of what can be done when odd things like this are investigated carefully. Another such opportunity seems to have appeared for this type of investigative reporting, though it would not be of the magnitude of the Watergate revelations.

The patently ridiculous docket 19759 calls out for such an investigation. How could such a docket ever come to be presented for serious consideration? If it made it through the normal decision making procedures of the FCC, then there is something radically wrong with the way this works and changes need to be made before more such idiocies emerge. If there was skullduggery, then the dirty work needs to be exposed and the people involved flushed out.

A person with persistance could follow up all of the trails of the docket, starting with the Electronic Industries Association and the companies which have been paying the piper for this "license to make money."

If the FCC does have clean hands in this, then they should cooperate with an effort to prove it. If some of the FCC officials have hidden motives, then a cover-up can be expected, with secrecy and buck-passing. Frankly, I suspect that there is the material here for a good solid congressional investigation.

73 A LITTLE THINNER

There are two "non-profit" ham magazines, one by charter (QST) and the other because I run it that way. The major difference between the two, from the financial end, is that I put every dollar that is available into making 73 bigger and better – and QST puts it into the bank. The result is that they have, at their last report, $1,072,000 in bank deposits and securities, and 73 has about one thousandth of that.

Normally this doesn't make any difference and 73 puts out as much magazine every month as the income will permit. The bind comes when something extraordinary comes along – like an IRS suit. This can get expensive and this is why most people faced with such a thing have to just give up and pay, no matter how outrageous the decisions. You do read every now and then about someone who has had the guts (and the money) to fight this bunch – it usually takes the shape of a small newspaper story on a chap who has fought them through the IRS courts for several years and who was finally found innocent.

The methods used by the IRS agents are the closest thing I've seen to the good old German Gestapo. They threaten and intimidate witnesses – they seem to be able to spend any amount of money for the most trivial items.

I'm just beginning to learn about this outfit, and what I've seen so far is blood curdling. They seem to prey on small businesses, the ones that don't have enough money to fight back and who just have to be closed down. If the expenses we've had are any indication, perhaps you can see why most firms just have to fold up. Our legal expenses so far have been over $20,000 – and that is just the beginning, with another $20,000 at least for the trial. I'll leave it up to you what a sudden expense like this would do to you or your business.

The one-sidedness of the IRS is so manifestly unfair that you might wonder why you haven't seen articles about it in newspapers and magazines. From what people who have been involved tell me, the IRS is extremely vindictive and the slightest adverse article often brings on a full audit and investigation – and you've read enough to know that they *always* find that you owe them money. The fact is that publishers are scared silly of the IRS and throw out almost everything that might stir up this hornet's nest of people who have almost unlimited power – and know it.

What does get into the papers are the releases that the IRS public relations departments send out. These are totally biased in favor of the IRS and are usually the rankest propaganda – and the victim has no recourse. Not only won't the paper publish his side of the story, if he can get it to them, he is faced with the reactions of his former friends and neighbors who have read one side and one side only – and harbor the strong suspicion that if the papers printed it, it must be true.

Well, at any rate, since 73 does not have any $1,072,000 put away in reserves, the expenses of the IRS suit have to be covered by printing a little thinner magazine for a few months. We hope that you understand.

You probably want to know what the case is against 73. So far as we can tell the great crime that has been committed – and this is a criminal prosecution with the attempt to put me in jail – is that the IRS, without asking me about these things, has decided that some items taken by our bookkeeper as business expenses in the years 1966-67-68 were actually personal expenses of mine and therefore the IRS has been defrauded. Just what all these things are will be brought out at the trial, but from what I've seen, they've decided to disallow trips to hamfests and conventions where I spoke, showed slides, and sold subscriptions.

My trips to foreign countries have been valuable – I've worked from many rare spots and this makes for 73 to be better known – and gives me better perspective to write and edit 73 – and the articles that I have written in 73 about my trips have been well received. The recent article on Jordan is a good example – without wide DXing experience I never would have made it to Jordan in 1970 – and thus I would never have had the opportunity to meet King Hussein and convince him that amateur radio would be of great benefit to his country with the resulting explosion of amateurs. We don't know where this will stop, but it should be obvious that the few dollars spent in my going to Jordan were well invested – the whole trip cost about $1000.

But what happens to a $1000 expense that is disallowed? Well, that means that there is an extra $1000 in personal income that was not reported – and this means perhaps $400 in taxes (how much tax do *you* have to pay on an additional earned dollar?). Add a 50% fine to that for not reporting it and you have $600 – then add interest to it for seven years at 6% and it magically escalates to $902! But you're not through yet. Since that was disallowed as a business expense, that means that the business had $1000 in unreported income – but the tax on that is probably only about 33% – or $333. . .and then you add in the 50% fine to bring it to $500. . . and then the interest for seven years brings it to $752. Add the two together and you have a tax of $1654 on a single disallowed $1000 expense. Now you can see how the IRS comes

(Cont. on page 102.)

CONSIDERABLY SPECIAL CONSIDERING THE SPECS

2 METER FM TRANSCEIVER **Model SRC-146A**

Frequency	143-149 MHz (2MHz spread)
Number of channels	5 Supplied with 146.94 simplex, 146.34 / .94 (same plug in crystals as SR-C826M)
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Options: *Private channel (CTCSS), external mic, or mic-speaker, stubby flexible antenna, desk top charger, leather case.*

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NEW 2 METER REPEATER
SCA-RPT-1
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SSTV SCENE

Dave Ingram K4TWJ
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Birmingham AL 35210

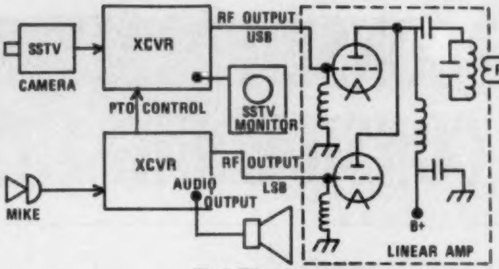


Fig. 2. ISB with two transceivers.

The 73 Slow Scan video program contest we first announced last month is off the ground, and happening right now until December 31, 1973, so get 'cracking on an outstanding program tape, (and I hear some of the gang really have some good ones planned) and win yourself a Robot Model 61 fast scan viewfinder. This contest is for the most interesting SSTV Program, with technical aspects also counting in the scoring. The "program" time limit is 6 minutes, and entry cassettes with sufficient return postage enclosed, should be sent to 73 Magazine. From here, they will go to "another" judge. The main objective of this contest is to get more fellows thinking and acting in terms of good programs, not just IDs and CQs. We're not stopping with just this contest, either. In February, we're joining with CQ Electronica of Italy in the 1974 Worldwide Slow Scan contest, and will present certificates to many U.S. and world leaders. More on this closer to that contest time.

Slow Scan continues to grow in popularity while also boasting some of the more exotic ideas in ham communication today. One example is a "SSTV Graphic Slate," which is presently being developed by W0LMD. This device would allow one to sketch out a Slow Scan picture, ID, schematic, etc., on the unit's built in cathode ray tube with a special "pen." This pen looks like a little pencil flashlight, but acts as a light sensor, rather than a light source. So, rather than actually marking on the crt face with ink, the "pen" makes lines which appear as black on the white raster of the crt. The drawn picture stays on the crt (and can be transmitted on Slow Scan) until the "memory erase" button is pushed, clearing the crt face, thus preparing for the next picture. Visualize the operation like this: An "overlay" of a schematic is placed on the crt, and traced out with the pen. The overlay is removed, and there, on the screen is the schematic. A block diagram of the unit appears in Fig. 1. Briefly, the unit works like this: A cathode ray tube produces a raster and a "light pen" generates a signal when light detection occurs at a spot pointed at. A 15,360 bit shift register memory traces the raster, and when the light detection occurs a blanking bit is set into the appropriate memory position. The detected light spot is then blanked on subsequent raster scans by a Z axis amplifier driven by the memory output. The drawn circuit, or message, is thus recorded on the refreshed crt "memory" screen. This drawing process continues until the desired picture is completed, then the memory clock slows down from 614 kHz to 1920 Hz to output memory at the SSTV rate. The crt is an old 9" TV crt, and the light pen uses a phototransistor and focusing lens assembly. The unit's memory costs approximately $60, and a complete unit would probably be around $100. Incidentally, Robert also now has available schematics, scope patterns and descriptions of both the W0LMD SSTV keyboard and the W0LMD scan converter (approximately 13 pages worth!). Cost to reproduce and mail each set is $1.25.

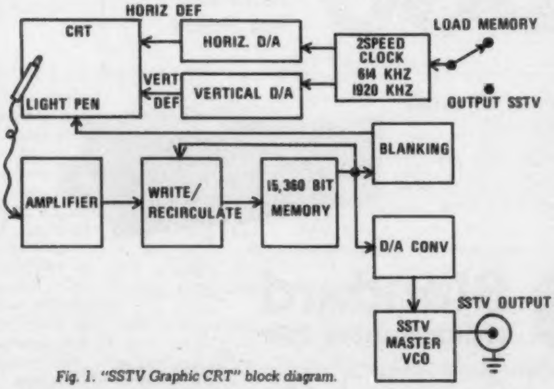


Fig. 1. "SSTV Graphic CRT" block diagram.

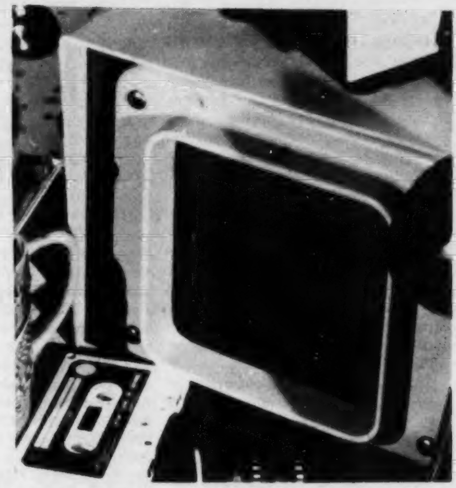
Another company, Venus Scientific Inc., of Farmingdale, New York, recently entered the Slow Scan field and should have their monitor available by the time you read this. Venus, as you may know, has built cathode ray tube high voltage modules for some time, so it was only natural for them to use some of them in such a related field as Slow Scan. Their monitor, designated the SS-2, is quite compact compared to other units and displays a picture of approximately 8.3 cm square. The unit is all solid state, completely self-contained, uses electrostatic deflection, and has a double purpose front panel control for either manual vertical retrace or frequency spectrum analysis (called accu-sync and similar to the system described in my June SSTV Scene column) of the incoming SSTV signal. The front panel crt bezel is constructed to accept an optional viewing hood or polaroid camera adaptor, and a front mounted "flip down foot" is provided for convenient viewing. The circuitry is primarily constructed on 3 plug in pc cards, which include LED sweep indicators for fast servicing in the field. Well, it sounds like manufacturers are getting hot on what Slow Scanners want, and are trying to deliver. I understand they are even working on a direct fast to Slow Scan converter. Fine! I have heard (through the "grapevine") the SS-2 crt is a special square face unit and suspect a special focus system may be used also. Since the "electron activity" is confined to a relatively small screen, brightness may be fairly high. Although I have not seen their unit as of this writing, I hope to shortly, so I can give you the full evaluation story.

An interestingly different approach to ISB (transmitting audio on one

73 1st Annual magazine's

RULES:

- 6 minute maximum time length
- Subject matter is limited only to your imagination — anything goes.
- Label cassette with your return address and include sufficient return postage. All programs will be returned.
- Decisions of the judges will be final.
- Contest starts now — entries must be mailed before December 31, 1973.



First Prize

ROBOT Model 61
Fast Scan Viewfinder
Other prizes to be announced.

Send your entry to: Slow Scan Contest, 73 Magazine, Peterborough, NH 03458.

---

sideband, and SSTV on the other sideband simultaneously) which is presently being investigated by Bill W4CVS, is shown in Fig. 2. Here, a pair of identical transceivers (like SB 101s) are shown feeding a common linear amplifier, (one using a pair of 4-400s, for example) whose plates are in parallel, but control grids are fed independently from each transceiver. The "SSTV transceiver" is on upper sideband and the "audio transceiver" is on lower sideband. Each tube in the linear amplifies its respective signal, and feeds it to the output tank circuit, thus resulting in an ISB output signal. A relay switching system connects each rig to a separate antenna on receive. Note, the two transceivers use a common ptc, thus tracking together (but on opposite sidebands) to eliminate frequency "zeroing" problems. I believe Bob WA7MOV, tried a system somewhat similar to this a while back, in which the two transceivers fed one linear amplifier through a phasing line system, described in the Editors and Engineers Handbook as a "magic tee" network. I suspect others will be trying ISB before long by just using the old mobile rig on an extra antenna for audio, and the "big rig" on Slow Scan.

I have word that XW8CO, FM7WW and a certain KG6 should be on Slow Scan about the time you read this, so you might like to keep your eyes and ears open (probably on 20m) for these new countries.

The Newtronics 4BTV Vertical

Recently I found myself in need of a good omnidirectional antenna for the 40 through 10 meter bands. Often the band would be open in three directions simultaneously, and I was missing too much DX which seemed to be always off the sides and back of my 3 element beam. Further, I was spending more time turning my beam than I was operating during large Slow Scan TV round tables. (There's enough fumbling in the shack already!)

At this point, I laid a dozen or so radials and erected my old (commercially built) trap vertical. My desires of coverage were met, and the results were gratifying. The bandwidth and SWR were not. In fact, the antenna was only usable on the upper portion of 20 meters, due to high SWR.

After careful study of the available antennas, a decision was made and a Newtronics 4BTV vertical was purchased. I put the antenna in my car (it's packaged in a nice, small box) and headed home.

The antenna and transmission line connectors went together smoothly within an hour, thanks to the fine instruction manual and tuning charts. If you go strictly by the chart, the antenna will work right off with low SWR on all bands. Naturally dimensions are given for either ground or roof mounting.

Then I went outside to mount the antenna and run more (approximately 15) radials. Here I found a dandy idea

Newtronics doesn't emphasize nearly enough. The antenna proper slips over and clamps to its base. Thus you can mount the base, run transmission line, radials, etc. Then just slip the antenna over it. This feature is extremely handy when tuning the antenna for your favorite frequency, as I will describe later.

The antenna worked perfectly from the start, with an SWR never over 1.3:1 on any part of any band. I was pleasantly amazed! QSOs with Europe and Australia the first day confirmed the antenna was working. Indeed, I often swapped between the beam and vertical during contacts, and the results were equal signal reports.

I measured the impedance with an Omega T noise bridge and again was surprised – 48 to 52 ohms on all bands! (I'll never tell what my beam was.)

Newtronics was encouraging on fine-tuning the antenna, so I tried adjustment. Originally the resonant frequency (1:1 SWR and 51 ohms impedance) was 14.130 kHz. I retracted the 20 meter adjustment slightly, and moved the exact resonant frequency to 14.230 kHz, my favorite spot. Checking the extreme band edges now showed a 1.3:1 SWR. Thirty minutes later, I had the antenna tailored exactly to my needs on all bands.

The real proof of this antenna came during the first of 1973, as I tried for the 73 73 73 award (work 73 countries during the first 73 days of 1973). I accomplished it with over two weeks to spare, and used the 40–10 meter bands. Often the TR-4 was used barefoot. However, all contacts were made using only the 4BTV (and some of those were quite exotic DX).

Now the proof period is over and I'm still enjoying the antenna. Last night, for example, I exchanged good quality Slow Scan TV pictures with TU2DO on Africa's Ivory Coast.

I've heard a few people say verticals didn't work for them, or radiated poorly. Closer investigation with these people revealed they had not followed proper construction techniques (home brew) or instruction sheets (commercially built). Often the vertical(?) was mounted 15 or 20 feet above ground on a metal pipe, strapped to a chain link fence. Some used radials, some didn't. This is no good. *Follow the directions.* Either mount the antenna at ground level, with radials (preferably two for each band) or on the roof, *insulated* from ground with 45 degree drooped radials to form a ground plane. Then results will be optimum and I think you will agree the Newtronics 4BTV is tops.

K4TWJ

50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

The September contest came and went without much of a stir. . .the high point in the eastern half of the country was an excellent quality Aurora for a few hours Sunday afternoon. W8CCI, VE2DFO, WB2LZD/3 and several others were very active on scatter. Cross your fingers, perhaps December will be better.

How many suffered coronary problems when Rayburn KH6HPV, called CQ and recovered when they heard the portable 5 tacked on the end? Vern W0CYF, has returned to six after many years absence. Kevin W1GAO, mobiled from Boston to St. Louis and back making two meter contacts all the way. What, no six meter gear in the car?

Dick WA5CHK/DA1RG, writes from Germany that his tour of duty will be over after the first of the year and by early spring expects to be back in Houston with his TR-6, Mark 6B and four 9 element beams at 70'. Dick says he is active on the DC bands and 2 meters but nothing takes the place of six. He is looking forward to working scatter with K8LEE, K8MM, et al.

Bob WA2AAR writes to tell of a new narrow shift RTTY net becoming active on 50.130 in the New York-New Jersey area. The net, which doesn't have a name as yet, will meet Sundays at 11 AM eastern time. Anyone desiring more information may contact Bob at 164 Steuben Street, Jersey City NJ 07302.

From Art WA1EXN: "At about 1508 Z, July 30, W1ELP called me and stated he was hearing a CW signal at 50.158 and wanted me to monitor and see if I could also hear it. Here is what I got at S4 with QSB from 1510 Z to 1550 Z. Beam heading 160 degrees. GYS DE SWIE SP 768 K (with sometimes a K in place of the Y). We tried reciprocal headings, Bill could hear the signal, I could not. . .Does one of your readers have an answer as to just what we might be hearing?" In a later on-the-air conversation Art mentioned that the above had been heard again. Does anyone have the answer?

For several months I have been trying to find space for a lengthy and most interesting letter from Geoff Wilson VK3AMK. To get it in it has been necessary to edit rather severely and to bend Wayne's space limitations. Consider this my apology to both.

"The frequency allocation for all VK call areas is 52-54 MHz. Up until 1964 we had 50-54 MHz but lost the lower 2 MHz to TV. The band is now sandwiched between our Ch. 0 (45-52) and Ch. 1 (56-63). The allocation of Ch. 0 was a very bad mistake as the QRM on this frequency is particularly bad during the summer sporatic E season when the three main high power Australian TV stations not only QRM each other but also cause QRM to TV reception in New Zealand on their CH. 1 (44-51). Operators in Melbourne and Brisbane suffer very much the same QRM troubles as U.S. stations operating near your Ch. 2. Despite this many stations are active in these areas. In fairly recent times there has been increased FM activity, mainly on 52.525 MHz and many stations use this frequency exclusively. The great majority of operators use AM or SSB, using the section 52.0-52.5. SSB is becoming increasingly popular with at present about 65% of the stations using this mode. AM on six is fast giving way to SSB except in the case of the younger operators just starting out, but even here some are going SSB. Until very recently there was no commercial gear available in VK apart from exservices or commercial equipment (surplus, ed.). At present about 50-60% of the SSB gear is commercial and with few exceptions consists of Yaesu FT-101s, FT-200s, etc., driving FTV-650 transverters. The power limits in VK are 150 W dc input or 400 W PEP output. But, very few stations are running this sort of power, mainly due to the extremely high cost of tubes.

The only recognized calling frequency is 52.050 MHz for SSB. This has been in use about two years and has worked out very well. There is virtually no CW on the band here except for meteor scatter operators. Many of the people on six are operating under similar licenses to your Technician class and *cannot* use CW.

The DX period is mainly late October to February which is our summer Es season. However, we are finding more and more that openings occur at any time and to help give a better picture of what is happening a number of beacons have been set up between 52-53 MHz, including several in VK0.

Normal contacts vary with location, equipment, etc. But, I can work most stations within 180 miles or so at any time with a pair of 6146Bs and a 6 element Yagi at 52'. I have kept daily skeds over a very mountainous path of 140 miles and never been unable to copy my report. Usual signals are about 5X6 each way with QSB to S9 plus at times.

Our normal Es season DX would average about 1000 miles single hop. From this area (Melbourne metropolitan) we mostly work stations on the Northcentral coast of VK4, about 300 miles north of Brisbane. I regularly work stations in this area during the summer months running 300 mW of SSB. We consider it a very bad season here if we don't work VK1-8 at some time during the summer. There has not yet been a two-way QSO with the Antarctic continent. But another Melbourne station (VK3BFG) and I were copied by VK0PF during late 1971 but were unable to hear VK0PF's signals despite 20 meter liason. We usually work ZL stations each year but lack of activity there is discouraging. Stations in northern Australia regularly work JAs between 52 and 52.5. Very rarely do we get JAs further south, although they have been worked in VK7 fairly recently. The signals from JA come via F2 into northern VK and are carried from there to VK3 etc., via sporatic E extension. In other words, if the JAs are coming into VK4 and we also have sporatic E to that area we may hear and work JAs. In 10 years of concentrated activity there have been three really workable openings.

Back in 1958-59 VKs worked into XE, but since losing the lower 2 MHz of the band DX is much harder, not only because many stations do not operate in our section, but also because the MUF doesn't always rise that extra 2 MHz. (I often get ZL TV video on 46 MHz, but no sound on 50 MHz until the MUF really peaks up.) Northern VKs have worked HL, KX6, KH6, etc., apart from JAs recently."

With the recent increase in interest in reactivationg TV Ch. 1 for educational purposes U.S. amateurs would do well to heed the warning in Geoff's letter and in the recent FCC 220 proposal.

...WA0ABI

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Oct. 27-28	CQ WWDX Contest, Phone
Nov. 2-5	CHC/FHC/HTH QSO Party
Nov. 5-11	QRPP CW QSO Party
Nov. 10-11	EX-G Contest
Nov. 24-25	CQ WWDX Contest, CW
Dec. 1-3	Delaware QSO Party
Dec. 15-16	EA (Spanish) Contest, CW

OCTOBER

CQ World Wide DX Contest, Phone

From 0000 GMT Oct. 27, to 2400 GMT Oct. 28, 1973. All bands 160 through 10. Three divisions: (a) single operator, single or all band (b) multi-operator, single transmitter (c) multi-operator, multi-transmitter. Only one signal per band permitted. Exchange RS/T plus your CQ zone. QSO point values: 3 points between stations on different continents, 1 point between stations on the same continent but in different countries; contacts between stations in the same country are permitted for Zone and/or Country multiplier but have no QSO point value. Multiplier is sum of zones and countries worked on each band. CQ Zone and ARRL & DARC country lists are to be used. Final score: (a) single band – zones plus countries multiplied by QSO points (b) all band – sum of zones plus sum of countries from each band multiplied by total QSO points. Use a separate log sheet for each band, 40 contacts to the page. Indicate zone and country *only first time* it is worked on each band. See the appropriate issue of CQ for official rules and list of 25 trophies. Official log and summary sheets are available from CQ. Include a large SASE or IRCs. Address is: CQ World Wide DX Contest, 14 Vanderventer Ave., Port Washington, L.I., NY USA 11050.

SSTV PROGRAM CONTEST

The 73 Magazine SSTV Program Contest will no doubt be a big hit with Slow Scanners. There is plenty of time to get your program together since programs may be entered anytime between now until Dec. 31st. See page 7 for complete details.

NOVEMBER
CHC/FHC/HTH/QSO PARTY

From 2300 GMT Nov. 2, to 0600 GMT Nov. 5, 1973. More complete details available from IARS at the address below. Suggested frequencies are 3575, 3710, 7070, 7160, 14075, 21075, 21090, 21140, 28090, 3770, 3775, 3790, 3943, 3960, 7090, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620, 28690, 50.1-50.5, 145-147. Exchange QSO number, RS/T, name, state and county (for U.S.), and give CHC number or FHC number. All who do not hold an IARS assigned CHC number are HTHers and send "HTH" as part of their exchange instead of CHC/FHC nr. Scoring system: CHCers score 1 point per QSO with other CHCers, 2 points if with an HTHer, count 1 additional point if contact – YL, blind/paralyzed, FHC, novice, VHF/UHF, CHC-200, merit, club station. Add above points. If contact was out of own country, double points for that contact. HTHers score 1 point per QSO with an HTHer, 3 points if with a CHCer, otherwise same as above. Same station can be worked on each band/mode. Each different continent, country, ITU zone and U.S. state is a multiplier. Each different band or mode used is a multiplier. Multiply total QSO points by total multipliers. Multi-op stations divide total score by number of ops used. Appropriate awards. (CHC means Certificate Hunter's Club, FHC – Flying Ham's Club, HTH – Hunt the Hunters). Mail logs and contestant form (available from IARS) within 15 days after end of party to: IARS, Inc., Clif Evans K6BX, P.O. Box 365, Bonita CA 92002.

QRPP CW QSO PARTY

From 1300 GMT Nov. 5, to 2300 GMT Nov. 11, 1973. Exchange RS/T, state (or province or country), and QRP number. Non-members of QRP-ARCI send "NM" and power in watts instead of QRP number. Frequencies are, 3540, 7040, 14065, 21040, and 28040 (plus or minus 5 kHz of course). Stations may be worked once per band for multiplier points. Member contacts count 2 points, NM contacts count 1 point. Power multipliers are – under ½ watt output, X15, – under 2 watts, X10, – under 5 watts, X5, – over 5 watts output – no multipliers. Multiply total QSO points by total state/countries and multiply this by power multiplier for final score. Appropriate awards. Logs must be readable and include date, time, exchanges, stations worked, band and power used. Enclose a cover sheet showing your computation of equipment description and statement that all rules were observed. Logs must be postmarked by Dec. 3, 1973, and sent to Earl R. Lawler W5JLY, Rt. 2, Box 24-K, Burnet TX 78611.

EX - G CONTEST

From 0000 GMT Nov. 10, to 2359 GMT Nov. 11, 1973. Maximum operating time permitted is 24 hours. Minimum time off for short breaks is 15 minutes. The contest is in three sections: (1) reciprocal operators, (2) non-reciprocal operators, (3) United Kingdom operators. Any licensed frequency and mode. Suggested frequencies are, 3950, 7250, 14347, 21415, 28650. Only the first QSO between two stations shall count for QSO points. Contest exchange from reciprocal operators – RS/T, serial QSO number, club member yes/no, and original call. From non-reciprocal operators – RS/T, serial QSO number, club member yes/no. From UK stations – RS/T, serial QSO number, club member yes/no, original call (if reciprocal operator) and name of football (soccer) team they support. (All references to "club" above mean the EX-G club). Scoring: Reciprocal ops score 1 point per QSO with non-reciprocal operators, 2 points if with a reciprocal operator. Non-reciprocal

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP
		Hz			
		Hz			
		Hz			
		Hz			
		Hz			

USEFUL RANGE (RADIUS)

EQUIPMENT

ANTENNAS & HEIGHT ☐ SPLIT SITE ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.

DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

REPEATER UPDATE
LISTENING
94 76 88 73 70 64 82. . .

AL	WA4UAG	Huntsville		145.992-147.126
AL	WR4ACS	Birmingham		146.16-146.76
AL	WR4ADD	Birmingham		146.34-146.94
AZ	WR7ABM	Tucson		146.28-146.88
AZ	WR7ABL	Payson		Planned
CA	WR6ACK	Santa Monica		147.83-147.33
CA	WR6ABX	Sacramento		146.37-146.97
CA	WR6ACG	Bishop		146.34-146.94
CA	WR6AAA	Catalina Is.		147.00-147.09
CA	WR6ABB	L.A.		146.01-146.61
CA	WR6AAD	L.A.		147.96-147.36
CA	WR6AAE	L.A.		146.22-146.82
IL	WR9AAF	Chicago		146.34-146.94
IL	WR9ABG	Elgin		146.19-146.79
IN	WR9ABA	Indianapolis		146.16-146.76
IN	WR9ABI	Elkhart		146.04-146.64
IN	WR9ABO	Muncie		146.13-146.73
IN	WR9ABR	Columbus		146.19-146.79
KS	WR0ABU	Kansas City		146.22-146.82
KS	WR0ABV	Lenexa		52.88-52.525
KY	WR4ACO	Owensboro		146.34-146.94
KY	WR4ACR	Lexington		146.16-146.76
MA	DL2AA/WR1	Medway		147.81-147.21
MO	WR0ABP	Barry		Closed
NC	WR4ABQ	Aurora		146.34-146.94
NB	WR0ABQ	Omaha		146.34-146.94
NY	WR2ABP	Bedford		147.705-147.105
NY	WR2ACG	Manhattan		146.40-147.00
OH	WR8ABT	Cheviot		146.07-146.67
OK	WR5ABW	Enid		146.34-146.94
SC	WR4ACD	Columbia		146.34-146.94
SD	WR0ABX	Sioux Falls		146.16-146.76
TN	WR4ACS	Nashville		146.16-146.76
TN	WR4ADA	Chattanooga		146.19-146.79
TX	WR5ABN	Midland		146.16-146.76
WI	WR9ABE	Baraboo		146.28-146.88
WI	WR9ABI	Madison	T2100	146.16-146.76

operators score 0 points with non-reciprocal operators, 2 points per QSO if with a reciprocal operator. Multiply QSO score by number of EX-G club members worked. Bonus points – multiply number of British stations (G, GB, GC, GD, GI, GM and GW prefixes only) operating from the UK by the following factors depending on your location: EU – X1, NA/SA – X3, AF, north of Lat. 10°N – X2, AF, south of Lat. 10°N – X3, ASIA, west of Long. 90°E – X3, ASIA, east of Long. 90°E – X4, AUSTRALASIA – X5. Multiply total QSO points by club member multiplier and add bonus points for final score. Appropriate awards. Logs before Dec. 25, to: Contest Committee, EX-G Radio Club, J. Kasser G3ZCZ/W3, Chairman, 1701 East-West Highway, Apt. 205, Silver Spring MD 20910 USA. SASE for results.

CQ World Wide DX Contest, CW

From 0000 GMT Nov. 24, to 2400 GMT Nov. 25, 1973. All other rules same as phone section. Complete details elsewhere in this column.

To date I have no information on the ARRL Sweepstakes Contests other than the dates. Nov. 10-11 is the Phone SS; the CW section is Nov. 17-18. You'll have to check the appropriate issue of QST for further details.

All contests this month appear to be international in coverage, so if you are a DXer, you could do worse than to enter a few of them. The CQ DX Test would be your best bet, of course. The SS Tests are not international in coverage, yet they are about the best contests around for USA and Canadian contest buffs. I will definitely be operating in the WWDX tests and the SS tests and hopefully a few of the others this month.

WB8KZD

the TRAVELING Ham

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

The frequency of the month is 144.480 MHz. It is widely used for simplex working in Europe and is also a repeater input frequency in Hong Kong. This month let's consider the two meter frequencies in use in Europe. Most countries in Europe have up to now "band planned" the occupancy of the 144-146 MHz (all they have) on a geographical basis. Stations in one area concentrate their signals into a section of the band, stations in another area use a different section of the band. Thus, when tropspheric openings occur hams know where to tune for the DX. Separate country wide frequencies are allocated for beacons, SSB or CW. All this is done on a voluntary basis by the hams themselves through their national societies and is not written into their licenses.

HOLLAND

Holland has no repeaters at present, but they have allocated simplex channels on a regional basis as follows:

Amsterdam	144.480 MHz
The Hague	144.800 MHz
Utrecht	144.700 MHz
Rotterdam	145.600 MHz

ENGLAND

FM Calling Channel	144.480 MHz
Mobile Calling (AM and FM)	145.00 MHz
Working South of England	144.400 MHz
Working London Area	144.800 MHz
Working Midlands	145.200 MHz
Working North of England	145.600 MHz

Europe is channelising the 145.00 to 145.900 segment of the band for FM with channels spaced every 25 kHz. The agreed new IARU channels for England are:

FM Calling Channel	145.500 MHz
Working Southern	145.525 MHz
Working London	145.550 MHz
Working Midlands	145.575 MHz
Working Northern	145.600 MHz

The idea being to establish contact on the calling channel and then QSY to a working channel. It will be interesting to see what happens when repeaters come into general use in England. The calling channel will then be the repeater channel, I suppose.

G3ZGO writes from London as follows: He suggests that visitors have 145.000 MHz and a means of copying AM (I suggest that the visitor carry a police band monitor that tunes down to 144.000 MHz. I used one in conjunction with a TR-22 last time I visited Europe and it worked out fine.). For built up areas he suggests 144.480 MHz. For very built up areas have one of the working channels too. For London have 144.800 MHz, as it will be nearly impossible to QSO on 144.480 MHz during busy times. In England the TR-22 comes with the following three channels fitted as standard: 144.48, 144.72, 145.32 MHz. The two meter band is shared with aeronautical services in England and several spot frequencies must not be used by hams. One of them is 144.72 MHz. So the rigs are usually tuned up to 144.725 MHz. Lastly, 145.32 MHz is used by SSB stations and they QRM the FM boys.

According to OHM Magazine there is at least one repeater in Hong Kong. The frequency is listed as 144.48 In – 145.64 Out, and there are over 20 VS6's active on two meters.

If you are going mountain climbing in Switzerland you might consider taking your handi-talkie with you. This summer one W3/HB9 worked into Italy, Austria and Czechoslovakia using an HT220 fitted for 145.000 MHz from the top of the Matterhorn. Some hams really live it up.

...G3ZCZ/W3

FCC NEWS

FCC EXTENDS TIME LIMIT FOR REPEATERS........

Adopted: August 29, 1973 – Released: August 30, 1973.

By Acting Chief, Safety and Special Radio Services Bureau.

1. The Commission has under consideration, on its own motion, the extension of the license term of all amateur stations licensed prior to October 17, 1972, and operating to automatically retransmit the radio signals of other amateur radio stations or as remotely controlled stations prior to that date. The purpose of our action herein is to preclude any unnecessary interruption of any on-going service due to delays in processing applications.

2. In Docket 18803 the Commission adopted rules pertaining to the licensing and operation of amateur repeater stations. Those rules became effective on October 17, 1972. All stations licensed after October 17 had to comply with those rules. However, to provide continuity of operation and to assure continued public service activities, existing repeater stations were granted a grace period to June 30, 1973, to bring their operations into full compliance with the rules and to obtain a new license. At the request of the American Radio Relay League this period was extended to August 30, 1973.

3. We find that more than adequate time has been given to those previously existing stations to allow their operations to be brought into compliance with the rules. However, because of the initially heavy administrative work load imposed upon the Commission, the fact that initially filed applications were generally inadequate, and because of the lack of processing personnel during the summer months, we find that there has been inadequate time for all existing licenses to actually receive their license documents evidencing their full compliance with the rules. Therefore, we will allow all amateur stations licensed prior to October 17, 1972, which were operating to automatically retransmit radio signals of other stations or as a remotely controlled station, and for which a timely and sufficient application for renewal or modification was filed to continue operation until final action is taken on the application. An application will be considered as being timely filed if it was received by the Commission on or before August 30, 1973. The application will be considered as one for renewal or modification if it proposes to license transmitting appartus which was previously operated as a repeater or remotely controlled station.

4. Accordingly, the Commission by the Chief, Safety and Special Radio Services Bureau, pursuant to the delegated authority in Section 0.331 (b) (1) of the Commission's Rules, ORDERS that all amateur stations licensed prior to October 17, 1972, which were automatically retransmitting radio signals from other amateur stations or licensed as remotely controlled stations and for which a timely and sufficient application has been filed, may continue to operate until such time as the Commission takes final action on the application.

FCC
Charles A. Higginbotham
Acting Chief, Safety
and Special Radio Services Bureau

........BUT BLAMES *AMATEURS* FOR PROBLEMS!

There apparently has been some confusion among amateur licensees as to the actual effective date of the rules adopted in Docket 18803. The Commission reiterates what should be clear to all amateur licensees that the rules became effective October 17, 1972. Licensees have been informed in the Report and Order, the Memorandum Opinion and Order, and by several Public Notices and Orders, that full compliance was expected as soon as possible but not later than June 30, subsequently all licensees have had adequate time in which to modify their operations and fully comply with our rules, although there may not have been sufficient time to obtain the licensing authorizations for repeater station, control station, and/or auxiliary link station. Licensees operating such stations under a previous authorization are cautioned their operations must otherwise fully comply with the rules. Licensees and control operators of stations not operated in compliance are subject to appropriate enforcement action.

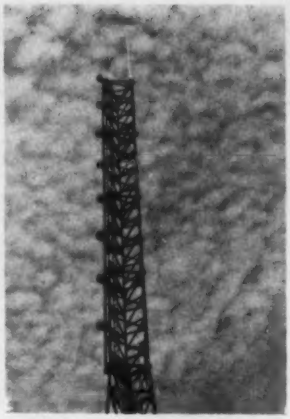
An excessive number of problems are being encountered with defective amateur repeater station applications, contributing to wasted effort and length processing delays. The principle problems are lack of standardization, failure to supply the required information, and/or failure to present the information in a manner permitting expeditious processing. Using the experience in processing thousands of these applications, suggest application forms designed to eliminate the most frequently encountered errors, are being developed. Whether these forms will be adopted as official FCC forms is undetermined. However, properly prepared applications based upon these suggested forms will be acceptable for processing. Amateurs are encouraged to develop more universally accepted terms and symbols for use in their applications.

. . .FCC

Looking West

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

It is easy to blame Mr. Walker for all that has taken place, but in retrospect isn't a good part of it our own personal fault? Most of us just sat back and waited to see what would happen, instead of doing something about it. We looked to people like Wayne to carry the ball for us. We laughed at the idea of a professional Amateur Radio lobbiest fighting for the kind of legislation that would advance our hobby rather than retard its growth. We sat there and permitted the rug to be pulled from under us. I only hope that it is now not too late to reverse the trend. If we don't our days may be numbered.



WR6ABE's new antenna atop Mt. Wilson.

What we need is mass public support and an image both recognized and well respected by the general public. We can no longer afford to wrap ourselves up in our own private world of tubes, wires and transistors. We must get out of our shacks and meet the public face to face and convince them that we are a necessary minority in the American society. How? Constact local Civic groups and alike and offer to speak to these groups about what we are and what we can do. Get to know people at one of the local radio or TV stations, and if you are lucky, maybe you can convince them to do a spot or two highlighting amateur radio on their public affairs programs. There are many other ways, both thru the mass medio and direct personal communication. Use your imagination.

Larry K6YLQ, in Oxnard reports to me about one real long haul repeater contact that transpired July 28 and 29, when a number of local amateurs found themselves keying up the KH6EQN 16/76 repeater some 3000 miles west of here in Hawaii. Now that's what I call DXing a repeater. Larry, who is with the WA6SIN repeater group drove up to the site to install a 16/ transmit crystal in the remote base portion of their machine and could hear the KH6EQN repeater atop Sulphur Mountain on his HT. He informed me that some of the other stations in this area who worked Hawaii during this opening were K6DYD, K6YNB and WB6OBB. He has a good part of it recorded on cassettes.

One of the guests who visited my home this summer was Abe Schwartz WB2PQR, Vice President and one of the original founding members of the Kings County Repeater Association. Abe's visit was more than a vacation. I still keep an active interest in my old group back east and I knew that they were in need of some equipment to get ZWP back on the air again. By the same token, I knew that Burt K6OQK, needed a new transmitter for his WR6ABE repeater atop Mt. Wilson. Since Abe and KCRA had access to what Burt needed, and Burt possessed the goodies that KCRA was looking for, a coast to coast swap was arranged and both sides are more than content.

While on the topic of WR6ABE, they now have a new Super Stationmaster and Duplexer for the machine, along with the replacement transmitter. That Stationmaster is at the very top of the tower and has not only extended the already fantastic coverage, but virtually eliminated most of the old dead spots. It took an all night work part to do the installation, but the results were worth the effort.

ELEVATION
ONE MILE
PLUS 320 FEET

Just add 150' of tower and 24' of antenna.

It looks like another 34/94 repeater has failed out here. This information comes from the source, the repeater's owner Bill Ogg WA6NGA. Like others in the past his effort to get a 34/94 open repeater going met the same strong opposition from those who use .94 as a simplex channel. After trying unsuccessfully to maintain the .94 output, Bill informed me that for the time being he has moved the output of WR6ABQ to 147.12, while maintaining the .34 input. Whenever the machine was put on the air there were numerous unidentified signals appearing on the input. This "jamming," coupled with the tremendous amount of high power simplex and remote activity already on .94, made the machine useless. It is evident that for the foreseeable future 146.94 will remain simplex. Though this is a loss to the traveling ham who visits L.A., it is evident that the majority of our 2m population seems to favor no repeater on 34/94.

. . . WA2HVK/6

Hi I'm AL W0JJK

What's in a name? These below are leading manufacturers. Likewise, mine is known to thousands of hams around the country and, I believe, W0JJK has a reputation for fair and dependable service. Please let me quote your needs!

Best of DX – 73, Al W0JJK

galaxy
Clegg
Cush Craft
CDE
hy-gain
MILLEN
JOHNSON
Calrad
SAMS
TRISTAO
TRIPP LITE
Weller
SUPEREX
Panel Meters
E-Z WAY products
TEN-TEC
TURNER
GONSET
SHURE
"VIBROPLEX"
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AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Activity at AMSAT headquarters is gaining momentum. With OSCAR 6 nearing it's expected lifetime, AMSAT is moving full speed ahead on OSCAR 7. Already funds have been set up and work has begun with an eye toward an early 1974 launch.

Tracking OSCAR 6 can sometimes be a difficult task. Someone has finally come up with an idea to permit amateurs to track OSCAR reliably time after time. William D. Johnston WB5GBG, has devised a plan using some of the characteristics of the satellite's orbit to provide each amateur with a computer printout that details the time the satellite will be overhead, the azimuth and elevation, plus distances for the entire pass. Because OSCAR 6 is in such a stable orbit we can predict orbital data to a very accurate degree far into the future with relatively no loss of accuracy. Furthermore the satellite has a repeating period of 263 orbits which means that the orbital data is the same every 263 orbits. This occurs about every 21 days, so that every 21 days the azimuth and elevation are the same. There are a few discrepancies in this, but the error is only about 7 or 8 minutes over a few months time which is easy to correct. Interested amateurs can write for more information to Bill Johnston WB5CBC, 1808 Pomona Dr., Las Cruses, New Mexico 88001.

If you would like a printout please send your: 1. Name and mailing address. 2. Latitude (indicate north or south) and longitude (east or west) in degrees, minutes and seconds. The local county or city engineer has this information in most areas. 3. Altitude above sea level (in feet or meters). 4. A SASE 9" by 12" or larger (not required for stations outside the U.S.A.) postage should be 48¢ for first class or 66¢ for airmail. The cost is $2.50 for U.S.A., Canada and Mexico $3 for first class and $3.20 for airmail (includes postage) and all other locations $3.50.

Many interesting and unusual operations are being reported from amateurs using OSCAR 6. A few of these are DXpeditions by FP8AA, PJ7VL, PJ9JT and ZK1TA and an aeronautical mobile by W6OAL. OZ7DX reports preparing for maritime mobile operation from the "Dana," a Danish research vessel. RTTY operation has been reported by VK3YDB, G3CUO, W6OAL and WA3EWJ. W9NTP, WA9UHV and SM6OH all reportedly have been active on Slow Scan Television, and WA6GUY reports successful facsimile transmission to WA3FVG/6 via the satellite. In addition, SSTV and audio tone ranging tests have been conducted by DJ4ZC, who uses the data for satellite orbit determination. Finally, all fifty U.S. states have been worked and confirmed by W3TMZ (shown in picture), who qualifies for the first OSCAR Worked All States award.

On June 30, AMSAT's board of directors authorized an acceleration of the AMSAT-OSCAR-B satellite project for completion in time for launching during the first quarter of 1974, and authorized additional expenditures (estimated at between $38,000 and $40,000) for the project. The required additional funding covers the salaries of two engineers and two aerospace technicians employed full-time by AMSAT. Also, funds for needed space-qualified components and ground support test equipment are provided by the ARRL and individuals who have made donations specifically for the purpose of completing the A-O-B spacecraft as rapidly as possible. General membership dues and general donations are not being used.

Assisting with A-O-B development are several groups in addition to the Washington area AMSAT members. These include the newly incorporated AMSAT Deutschland e.V., AMSAT's affiliate in Marburg, Germany (under the leadership of Dr. Karl Meinzer DJ4ZC, and Werner Haas DJ5KQ), QIA-Project Australis in Melbourne, Australia (particularly Dr. Peter Hammer VK3ZPI), the Jet Propulsion Laboratory Amateur Radio Club and the San Bernardino Microwave Society in southern California, and a group headed by Larry Kayser VE3QB, in Canada. Other individual AMSAT members in other locations include John Goode W5CAY, who is constructing another Codestore unit.

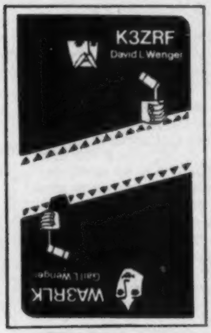
One final note for the amateur who would like to learn more about satellites and how they work, complete with a history of man's first attempts to orbit such a body. Stanley Macko's book *'Satellite Tracking'* appears to be one of the easiest to understand and one of the most descriptive books I have found.

Orbit	Date (Nov.)	Time (GMT)	Longitude of Eq. Crossing °W
4775	1	0008.7	49.8
4788	2	0103.6	63.5
4800	3	0003.5	48.5
4813	4	0058.5	62.2
4826	5	0153.4	76.0
4838	6	0053.3	61.0
4851	7	0148.3	74.7
4863	8	0048.2	59.7
4876	9	0143.1	73.4
4888	10	0043.1	58.4
4901	11	0138.0	72.1
4913	12	0037.9	57.1
4926	13	0132.9	70.9
4938	14	0032.8	55.8
4951	15	0127.7	69.6
4963	16	0027.7	54.6
4976	17	0122.6	68.3
4988	18	0022.5	53.3
5001	19	0117.4	67.0
5013	20	0017.4	52.0
5026	21	0112.3	65.7
5038	22	0012.2	50.7
5051	23	0107.2	64.4
5063	24	0007.1	49.4
5076	25	0102.0	63.2
5088	26	0002.0	48.1
5101	27	0056.9	61.9
5114	28	0151.8	75.6
5126	29	0051.8	60.6
5139	30	0146.7	74.3

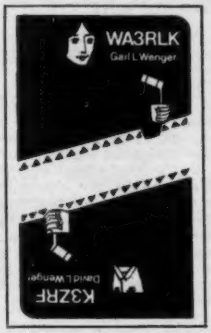
. . . WB8LBP

Jack Colson W3TMZ, first to work WAS via OSCAR!

QSL CONTEST



The winner(s) of the November QSL Contest are David (K3ZRF) and Gail (WA3RLK) Wenger of Lititz PA. The total inability of our contest judge to decide which side was actually the top resulted in the card's being reproduced twice. Win a one year subscription! Send your entry to: QSL Contest, 73 Magazine, Peterborough NH 03458.



HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Alan Kline
220 S. Common St.
Lynn MA 10905
596-6010

Ray Calabro
210 Country Club Dr.
Warwick RI 02888
401-781-4084

Greg York
RR 2, Box 434
Three Rivers MI 49093
616-279-2534

Robert White
365 Clinton River Dr.
Mt. Clemens MI 48043
468-4746

Allan Kowal
21-2800 Allwood St.
Abbotsford B.C. Canada
859-7928

John Diecker
9968 Northamton Dr.
St. Louis MO 63137
314-868-2905

James Taylor
1516 Sheley Rd.
Independence MO 64052
816-252-4844

INTRUDER CHASE

Jonathan Tara WB8DBN
16260 Greenfield
Detroit MI 48235

You're sitting there on 7240 having a nice QSO when suddenly your ears get socked with a 50 over carrier. Then, "This is the BBC transmitting to Australia." You grumble, "It's them damn ferren broadcasters again." But what can you do, it *is* legal if they don't point it at us, isn't it? Out of curiosity you look up at the time zone map. "Hmmmm, it's 2:30 in the afternoon in Aust. . .England to Australia?. . .at 2:30 in the afternoon? They're out of their bleeping minds!" What to do? Write to the BBC? Naw, Heaviside was one of theirs, they will claim that the ionosphere never sets on the British Empire. How about the Intruder Watch? That is no good either, they just sit there and *watch*. "Hey Joe, let's move up 5, I can't hear you through Big Ben. . "

Sound familiar? Then, congratulations! You have just given in to an intruder! You are not alone, though. This is the reaction most hams have to intruders. You get mad at first, then realize that there is nothing you can do.

Introducing the 73 Intruder Chase! The Intruder Chase is just what the name implies. It is intended to get rid of intruders *now*, not at the next frequency allocations conference. If we wait that long, as the ARRL seems to be doing, *we* will be the intruders! Before you start yelling at me for trying to dump the ARRL, let's take a look at the intruder situation in general.

Who Are The Intruders?

Take a look at the frequency table. 160m and the first 400 kHz of 80m are allocated in various parts of the world to non-broadcast services. Ah ha! So that's what all those funny

FREQUENCY ALLOCATIONS

Frequency (kHz)	Intruders
1800-2000	Any U.S. or Canadian non-amateur except Loran. Broadcasting anywhere.
3500-3900	Broadcasting anywhere.
3900-4000	Broadcasting to or from Western Hemisphere. Any U.S. or Canadian non-amateur.
7000-7100	Any non-amateur.
7100-7300	Broadcasting to or from Western Hemisphere. Any non-amateur except broadcasting.
14000-14250	Any non-amateur.
14250-14350	Any non-amateur, except for fixed station in the U.S.S.R.
21000-21450	Any non-amateur.
28000-29700	Any non-amateur.

QTH CHANGE?

To be absolutely sure that 73 will follow you to your new QTH, try to notify our Subscription Department at least 8 weeks in advance of your move. Please include your old address and call as it appears on your current mailing label – or better yet, send the label itself.

OLD ADR (or mailing label)

NAME ____________________ CALL ____________

ADDRESS ________________________________

CITY ______________ STATE ______ ZIP ________

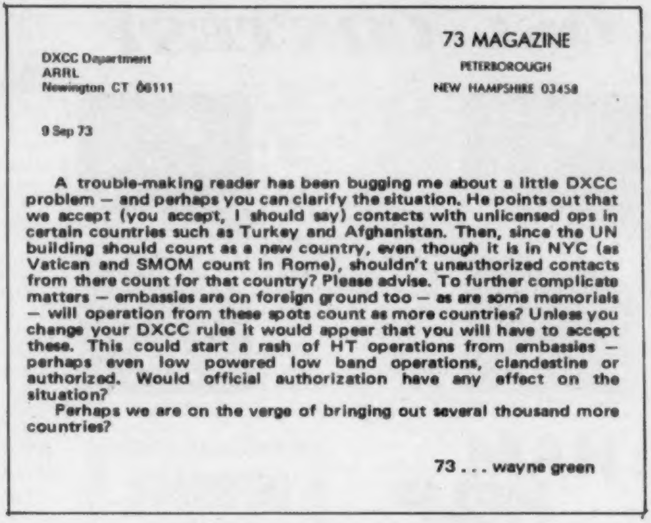
NEW ADR

NAME ____________________ CALL ____________

ADDRESS ________________________________

CITY ______________ STATE ______ ZIP ________

DXCC NEWS



73 MAGAZINE
PETERBOROUGH
NEW HAMPSHIRE 03458

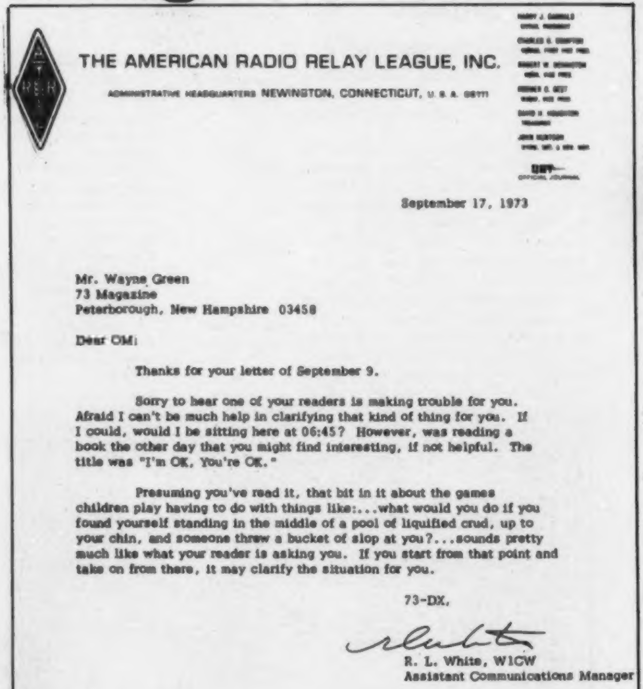
DXCC Department
ARRL
Newington CT 06111

9 Sep 73

A trouble-making reader has been bugging me about a little DXCC problem — and perhaps you can clarify the situation. He points out that we accept (you accept, I should say) contacts with unlicensed ops in certain countries such as Turkey and Afghanistan. Then, since the UN building should count as a new country, even though it is in NYC (as Vatican and SMOM count in Rome), shouldn't unauthorized contacts from there count for that country? Please advise. To further complicate matters — embassies are on foreign ground too — as are some memorials — will operation from these spots count as more countries? Unless you change your DXCC rules it would appear that you will have to accept these. This could start a rash of HT operations from embassies — perhaps even low powered low band operations, clandestine or authorized. Would official authorization have any effect on the situation?

Perhaps we are on the verge of bringing out several thousand more countries?

73 . . . wayne green



THE AMERICAN RADIO RELAY LEAGUE, INC.
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U. S. A. 06111

September 17, 1973

Mr. Wayne Green
73 Magazine
Peterborough, New Hampshire 03458

Dear OM:

Thanks for your letter of September 9.

Sorry to hear one of your readers is making trouble for you. Afraid I can't be much help in clarifying that kind of thing for you. If I could, would I be sitting here at 06:45? However, was reading a book the other day that you might find interesting, if not helpful. The title was "I'm OK, You're OK."

Presuming you've read it, that bit in it about the games children play having to do with things like:...what would you do if you found yourself standing in the middle of a pool of liquified crud, up to your chin, and someone threw a bucket of slop at you?...sounds pretty much like what your reader is asking you. If you start from that point and take on from there, it may clarify the situation for you.

73-DX,

R. L. White, W1CW
Assistant Communications Manager

RLW/fr

SINCE 1914—OF, BY AND FOR THE RADIO AMATEUR bleeps and bloops are! Unfortunately, those bleeps and bloops are legal. A common intruder in this part of the amateur spectrum is your local broadcast station – one of it's harmonics. For some reason, this seems to be worse during the day. Maybe that is because more "cheapie" stations are on during the day.

40 METER PICNIC

Frequency	Station	Time	Language
7050	R. Cairo (V. of the Arabs)	0300-0800	Arabic
7065	R. Tirana	0430-0500	Arabic
7090	R. Tirana	0430-	
7120	R. Peking[1]	0100-0155	English
7150	R. Moscow[1]	0100-0500	English
7150	BBC[2]	0545-0915	English
7240	BBC[2]	0545-0915	English

1 North American Service
2 Australian Service

40m is where the *real* fun begins. 7000 to 7100 kHz is an exclusive amateur band world wide, although you wouldn't know it by listening. *Anyone* other than an amateur caught between 7000 and 7100 kHz is illegal. 7100 to 7300 kHz is allocated to the broadcast service in the Eastern Hemisphere. The "catch" here is that they are not supposed to broadcast to the Western Hemisphere. Of course, this rule is not always observed. Some stations, like Radio Moscow, will come right out and say, "North American Service," in their schedules and on the air. Others are more sneaky, like the BBC case cited above. A good indication as to where they are *really* broadcasting to is where the letters on their mailbox program come from. If all the letters are from Podunk, Iowa, and they claim the broadcast is going to Outer Slabovia, you know there is something fishy. If there is a band on everyone's *WANTED* list after 220, it must be 40.

Intrusions occur less frequently on the higher bands, but they still happen. Usually the intruders on the higher bands will be "utility" type transmissions (Teletype, FAX, etc.). I remember once that there was a huge multiplex teletype signal parked on 20m. It had a signal every 2½ kHz from below 14000 up to about 14250! Another type of intruder in the higher amateur bands is harmonics from broadcast stations on lower frequencies. Thus, the same signal that is creating havoc on 40 can be QRMing 20 at the same time. After complaining to the BBC about a harmonic of theirs on 20m, they apologized and said that they had reduced the level of the harmonic 6 db, while at the same time maintaining that they did nothing illegal in the first place!

Next month I'll discuss what can be done about intruders. In the mean time, if you want to know more about the Intruder Chase drop me a line. I plan on an Intruder Net, so if you are interested in the net, please let me know so we can get one started. Also, if you have any "contributions" to the intruder list, please send them in.

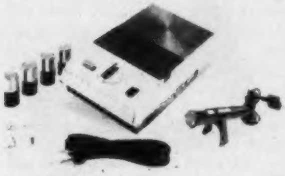
WB8DBN

The Hamburglar
STRIKES AGAIN!

AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241960	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459 NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327885	WA6WOA	4/73
R4B No. 11578G T4XB No. 17801 G W4 wattmeter No. 8390 Swan 250 No. F154806 Swan ac pwr. sup. No. 0853556	WA8GVK	6/73
HR-2 No. 04-C2879 SB-34 No. 211828	W6GSR	6/73
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW HR-2 No. 0302030	W4GF	7/73
Clegg 27B No. 72013-1088	W3BXL	7/73
Std. 826MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Tektronics 453 Scope	WB2FZU	8/73

NEW PRODUCTS

CASSETTE RECORDER SPECIAL



combination ac or self-contained battery operated cassette recorder – with the new one control feature instead of the old piano key type control.

This cassette recorder is ideal with 73's code course since it can be operated anywhere – at home – in the car – in the office (maybe in the drawer, with the earphone for silence). The single control switch is excellent for use in the car where you don't want to have to take your eyes off the road to use the recorder – to operate it for copying in your mind – for instant rewinding or fast forward. And this control doesn't have to be held either, a nuisance on most recorders.

Comes complete with four "D" batteries, ac power cord (plugging it in disconnects the batteries), earphone (you can even copy code without bothering the wife or family), and mike so you can make your own recordings of rare DX off the air when you get your license.

This cassette tape recorder is available for only $23.95 (plus $1.00 for

Publisher Tells All

Green Gets Life!

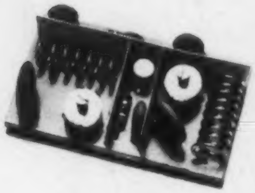
WASHINGTON (UPI) In front of the Federal Court House Building this morning, Wayne Green, publisher of 73 Magazine in Peterborough, New Hampshire, admitted to this reporter that HE IS a Life Subscriber to 73. He further admitted that he feels that being a life subscriber to 73 would make you a special person --- so he is offering you this special deal. If you send in this Life Subscription Blank, along with a check for $99, we will send you an order form from which you may select, FREE, your choice of our excellent books totaling up to $30.

The benefits of reading 73 are obvious . . . so why not treat yourself to a lifetime of interesting and informative reading about your favorite hobby. Short on cash? Just send $25 as an initial payment, and make three consecutive payments of $25 each.

The carefully hidden order form is on the reverse side of this column on the next page.

shipping and handling) to help you with our code course. Order it from 73 Magazine, Peterborough NH 03458.

2 METER PREAMP



Data Engineering has come out with a nice 2 meter preamp using Mosfets. We installed one of the preamps on the 146.19 receiver at 73s WR1AAB Repeater and were very, very delighted with the results. Tests showed about 20 dB gain and a noise figure of less than 2.5 dB. To put it another way, before the preamp was installed our receiver was exhibiting .4 µv for 20 dB quieting. With the preamp in the line the receiver is now good for .1 µv (20 dB quieting). That does make a receiver super sensitive. Contact *Data Engineering, 554 Port Royal Rd., Springfield VA 22151.*

TOUCH-TONE DECODER

It looks as though the age of Repeater Sophistication Devices is here. Although Touch-Tone has been used on repeaters for some time, until recently decoding was done with the aid of either one of Ma Bell's decoders, such as the 247B, or a decoder built up by some enterprising individual at a rather healthy price. Now however, one can find the perfect answer to Touch-Tone decoding. Data Engineering introduces their DE2171 Touch-Tone Decoder. Simply apply 5 volts and receiver audio to the decoder and you are all set to decode the standard 12 button Touch-Tone functions. The Data Engineering decoder has some very nice features. Probably the one thing about the decoder, in addition to it's small size and layout, is the fact that the output from the decoder is via reed relays. If you have ever "zapped" a nice solid state device with a transistor logic output, you'll have no problems with this decoder. The reed relays, though small, can take just about all you can hand them. All in all, thanks to Data Engineering for a small Touch-Tone Decoder with all the features you could want at a price less than what you would pay for one of Ma Bell's units. If, of course, the Bell units were ever for sale. Contact *Data Engineering, 554 Port Royal Rd., Springfield VA 22151.*

MITS CALCULATOR

Very handy, one might pun.

Like many of the newer gadgets available, once you get one of these hand calculators the chances are that you will find yourself using it every day and wondering what you did before you had it. Like Kleenex. There was a time when there was no Kleenex. Some of the old timers may remember those olde days.

MITS
908M
√x
1/x
x²
7
8
9
+
%
4
5
6
X
M
1
2
3
−
CE
C
0
•
+
=

The recent MITS ads have been featuring their 150-series calculators. A rather thorough research of the available calculators – and there are a great many on the market these days – indicated that only a couple had the recently developed memory circuit. Users of any of the older calculators will readily appreciate the importance of this for in any complex computation it has been necessary in the past to write down intermediate figures and then enter them later.

For instance, suppose you want to add 15% of $200 and 15% of $375? No longer do you have to do the two calculations separately and then add the results, with the new circuit you can do the 15% of $200 and then put it up in the memory while you do the 15% of $375 – and then add the memory number to the second calculation.

The number in the memory can be used for addition, subtraction, multiplication or division. Thus, if you have a series of discounts that you want to take on a series of prices, you can put the total discount perdentage in the memory and use that to multiply the prices. Reading out the memory does not erase it, so you can make a long series of calculations quickly.

The 150 also has a clever system for setting the decimal and rounding off numbers. By touching the (.) (=) (2) keys you then end up with all calculations rounded off to two decimal places.

The X^2, 1/X, and √ keys are great for many radio and electronic problems. You can whip off a $1/62.79^2$ in a flash. And you certainly don't need to cart around decimal equivalents of fractions anymore. The conversion from English to metric is fast with the calculator.

The % key is a small bonus for people who are not sure what a percent is and don't know that they'll get the same result by multiplying by the % number with a decimal point in front of it. 15% of $375 can be done either by (1) (5) (%) (3) (7) (5) (=) or (.) (1) (5) (X) (3) (7) (5) (=). Well, you save punching one key.

YES

Make Me a Lifer Too!

I agree that I am a special person and as such I DEMAND that 73 Magazine make me a Life Subscriber too! Green may be the publisher, but that sure doesn't entitle him to be the only one to save money on a lifetime of enjoyment. I deserve the same break – and make sure that you don't forget to send me a personalized life subscriber certificate signed by Wayne, along with the list of 73's great books for me to choose from.

☐ $99 enclosed ☐ $25 enclosed–bill me for the remainder

Name__________ Call__________

Address__________

City__________ State__________ ZIP__________

73 Magazine, Peterbough, NH 03458

There is a clever little battery saver circuit which turns off the readout numbers after about 15 seconds and indicates this with a little LED dash. Touching any key brings the figures back.

The MITS 150 is getting closer and closer to the Hewlett Packard unit, but without all those things that only a physicist might need. The 150 sells for about $130, or for $100 in kit form. The kit isn't all that difficult to manage, if you want to save $30. And, at $100, you will be hard put to find anything approaching this calculator anywhere.

Contact *MITS Inc, 6328 Linn Ave N.E., Albuquerque NM 87108.*

INSTANT CIRCUIT BOARDS

A set of drill mills are available which allow quality circuit boards to be fabricated from copper-clad material by simply drilling holes! Each mill, when powered by a hand drill or push-screwdriver, drills a small hole in the board and isolates a bit of the copper clad around the hole for soldering purposes. Three sizes are offered so the size of the isolated pad may be matched to the components you are using and the degree of miniaturization with which you are struggling. The largest is suitable for mounting standard sized components while the smallest can be used to fabricate mountings for in-line IC packages.

The drill-mills are extremely easy to use. After an outline of parts placement is drawn, the location of each proposed pad is marked through the layout onto a piece of copper-clad with a center punch, ice pick or other common workshop item. Then go to it with the drill-pads. If there are only a few holes to make, one needn't even get out the drill. The mills are extremely sharp and pads can be made in most board material at the rate of two per minute with only a large knob mounted onto the shaft and a little wrist action. This method lends itself nicely to the "plan-as-you-build" school of construction and also to experimenting. . .mount a component – decide where the other lead will fit best – then drill the small isolated pad.

Unlike working with normal P.C. boards, isolated-pad circuitry can easily be modified. Since connections between components are not etched but wired, a little work with a soldering iron can change things around considerably without ruining the board. These little drill-mills are truly an experimenters tool!

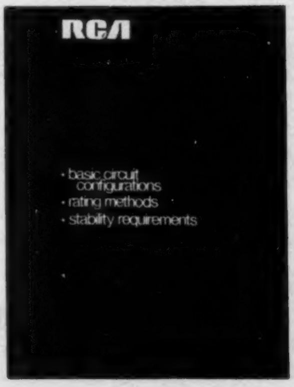
The three sizes availalbe will make isolated pads 0.20, 0.15 and 0.10 (inches) in diameter. Each is supplied with its own internally mounted no. 60 drill, which can be easily replaced. The price is $6.95 each.

For more information contact *A. F. Stahler Co., P. O. Box 354, Cuertino CA 95014 402-262-4219.*

POWER AMPLIFIER BROCHURE

A 20-page brochure that describes basic concepts and techniques employed in the design of transistor audio power amplifiers and 38 silicon power transistors specially selected for use as input, driver, output and overload-protection devices in such amplifiers are available from RCA Solid State Division.

RCA Publication No. APA-550, "Audio Power Amplifiers," describes significant design features, basic circuit configurations, rating methods and stability requirements for transistor audio power amplifiers. The classes of amplifier operation and selection of the optimum class for a given output-power level are discussed, power-amplifier drive requirements are defined and the effects of operating conditions on circuit design are analyzed. The basic circuit configurations used for audio-output stages are evaluated. The methods used for rating audio power amplifiers are compared and the power-output and dissipation capabilities of class B audio amplifiers are explained. The effects of changes in temperature, or large signal phase shifts and of excessive levels on amplifier stability and the techniques used to compensate for these effects are pointed out, and methods used to protect the output transistors against short-circuit load conditions are shown.

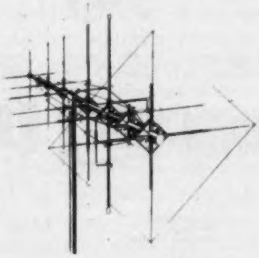

RCA

- basic circuit configurations
- rating methods
- stability requirements

Anyone wishing to firm-up or expand their knowledge of audio amplifier design is invited to write for their copy of APA-550. Contact: RCA Solid State Division, P. O. Box 3200, Somerville NJ 08876.

2KW CB ANTENNA ANNOUNCED!

(hmmmmm . . . .)



A new "super power" CB base antenna has been announced by Avanti R & D. Called the MOONRAKER 6, it is a 6-element, dual polarity beam combining five sets of crossed dipole type elements plus a quad type reflector for better rejection and gain. Tunable gamma matching on both the vertical and horizontal elements handles over 2,000 watts of power(!), gets the lowest possible SWR, is said to provide excellent lightning protection and to be virtually trouble-free.

In addition to the exceptionally high power potential, Moonraker 6 specifications include 17 db gain over isotropic, 44 db rejection, 24 db side rejection, and 1.2:1 VSWR. Contact: *Avanti Research and Development, 33 West Fullerton Avenue, Addison IL 60101.*

ALLIED ENGINEERING CATALOG

Allied Electronics (Division of Tandy Corporation) has published their new 1974 catalog #740. Previous catalogs have served as the electronics industry's "answer book," and the new catalog is even better. The prime feature of the Engineering Manual & Purchasing Guide catalog is the includ-

(Continued on page 111)

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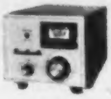

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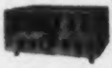

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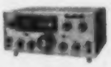

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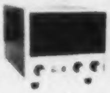

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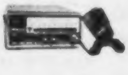

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The SP101-P Landliner provides phone patch operation as well as speaker. Front panel: Patch switch, meter, TX and RX gain controls. Rear apron: Receiver 4 ohm output, receiver 600 ohm output, monitor null switch, balance control, line jack, transmitter high Z jack.

The FV-101 permits split frequency operation and control from either the FT-101 or FTDX401.

The FT-101 exciter covers 160, 80, 40, 20, 15, (CB), and 10 meters and comes complete with microphone cable and plug, fused DC power cable and plug. AC cable with plugs and all necessary plugs are furnished. AC and DC supplies are internal.

The FL-2100 linear amplifier needs only 3 wire cable and coax cable. Connectors are furnished.

FTdx401 features high power, super sensitivity and sharp selectivity. The FTdx401 includes: AC power supply, noise blanker, 100 KC and 25 KC calibrators. VOX break-in, phone patch terminal, cooling fan. Covers 3.5 through 10 MHz plus WWV. 560 watts PEP. All that is required to get on the air is a microphone and speaker.

The FV-401 permits split frequency operation for the DX chaser or net operator. Covers 80 through 10 meters.

FL 2000 B 1200 watts PEP, 1000 watts CW, 600 watts AM. Drive power required 100 watts. Has two cooling fans and uses two 572 B tubes.

FRdx400 includes 2 mechanical filters plus "T" notch rejection tuning, and clarifier for easy zero set for SSB. Crystal control 1st mixer and tunable 1st I.F. provides stable operation and high spurious rejection. 100 KC and 25 KC calibrators. VFO can be used in transceive operation in conjunction with F series transmitter.

FLdx400 operates SSB, (USB LSB selectable), AM, CW and FSK. Circuitry can be built in for RTTY operation. 240 watts PEP. VOX, PTT, and break-in CW.

FL-2000B grounded grid linear uses a pair of 572 B tubes. Plate meter VSWR monitor, 2 fans, built-in power supply, 80 through 10 meters, 1200 watts PEP with distortion product in excess of 30 DB down.

FP-2 AC power supply specifications: Output - 13.5 volts, 2 amps. AC input - 100/117/220/234 volts. Speaker - 5" x 3-1/5". Portable or home base operation can be achieved with the addition of the optional FP-2 power pack. This AC power pack provides regulated DC power for the transceiver and charging voltage for optional leak proof rechargeable colloidal type batteries. In addition, a high fidelity elliptical style speaker is built into the pack.

The FT-2FB opens the door to noise free broadcast quality 2 meter operation, and thanks to the repeater stations throughout the country, the 2 meter band is no longer restricted to line of sight. General coverage 144 to 148 MHz, 12 channels (3 supplied). Push to talk. Receiver .3 amps, transmit 1.7 amps, power source 13.5 volts + 10%. Dimensions 6-3/8" w. x 2-1/2" h. x 10" d., weight 4 lbs. Comes with dynamic microphone, connector plug, DC cord, fuse and mobile mount.

The FT-2 auto is a compact base or mobile VHF/FM transceiver, covering 146 to 148 MHz, featuring electronic scanning up to 8 stations between 146-148 MHz with priority channel sampling while locked on another channel. Adjustable tone burst push-button lock on for repeater actuation. The FT-2 auto is self-contained. Two power cables are supplied with the transceiver, including all mounting hardware, cables, connectors, and accessories required for both mobile and base installation, as well as dynamic push to talk microphone. Operates from various AC voltages or 13.5 DC. Dimensions 8-3/4" w. x 4-1/4" h. x 11-5/8" d. Weight 9 lbs.

SPECIFICATIONS

	YC-355D			YC-355D			YC-355D
Frequency range	5Hz to 250MHz (50Hz to 200MHz)	MAX Input Voltage		60Vp-p, less than 10 sec (5V p-p)			220(W)X80(H)X270(D) (8 3/4 W X 3 3/4 H 10 1/2 inches)
Accuracy	± time base stability ± 1 count						
Display	5 Digit	Input Impedance		HIGH: 1 M ohm, Low: 50 ohms	Weight		
Sampling time	1 milli-sec or 1 sec	Input Capacity		Less than 20pF	Tube	Display tube	5
Display time	0.1 sec – 2 sec	Time base Frequency		1 MHz Crystal controlled	Semi-conductors	Silicon diode	12
Frequency Unit	KHz, MHz	Stability		0.0005% at 25° C 0.0025% at 0° ~ 40° C		Silicon transistor	8
Display	Display tube					FET	1
Input Voltage	30mV–20Vp-p (0.15V~5Vp-p)	Power Requirements	A C	100/110/117/200/220/234V 50/60Hz 18V A		IC	26
			D C	12~14.5V 1A			

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GETTING STARTED ON 450MHz

The Basics -

- *Crystal Controlled Signal Generator*
- *Modulator*
- *Infinite Attenuator*
- *Wavemeter*

This article describes a good crystal oscillator signal source for 450 MHz FM work. It is one of a series on how to get going on 450 MHz FM. You have to work a little harder on this frequency, and this series will be of help You must have – or make up – certain pieces of test equipment to help you get into the UHF region. But the real amateur fun you will get out of it, if you have even a drop of experimenter's blood in you, will be well worth your while.

General

This 450 MHz crystal controlled source is about as simplified and straightforward as you can get on 450 today. All three stages combine the results of many years of past work on my part, beginning in 1946 with an article entitled "Getting Started on 420." History does seem to repeat itself.

There are many pitfalls along the way to a really good signal source, surefire and reliable, on 450 MHz, and we will guide you through them, with luck, and you can go on from there. If you make this rig exactly as shown, it will provide you with a good signal source from 420 to 450 MHz, by changing crystals and retuning very slightly. You can use it first of all as a signal generator and by sliding it into an aluminum tube (as shown in Fig. 5) you can add an infinite attenuator to it. This will allow you to make repeatable low noise, high sensitivity tests on any receiver you build for 450 MHz. You can also use it as a guide for an L.O., or as the beginning of a one watt or more FM rig. I used a 48 MHz crystal because, being an old 2 meter DX'er, I have a lot of rocks lying around near the band edge. The 50 MHz one comes from my old 6 meter days.

Figure 1 shows the entire signal source. Note the simplicity throughout: all tuning

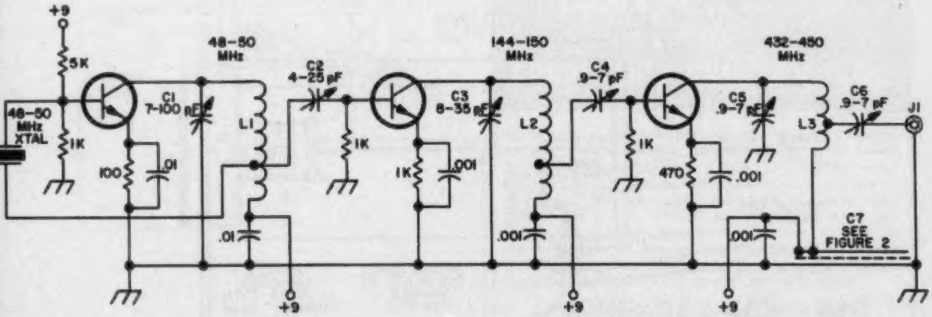


Fig. 1. 450 MHz signal source. All transistors are HEP 75. L1, 20 turns No. 24, 8mm long, 5mm diameter form. Tap at 8 turns from cold end; L2, 5 turns No. 20 tinned copper, 19mm long, airwound, 8mm O.D.; L3, 3 turns No. 20, 11mm long, 5mm diameter. Tap in center.

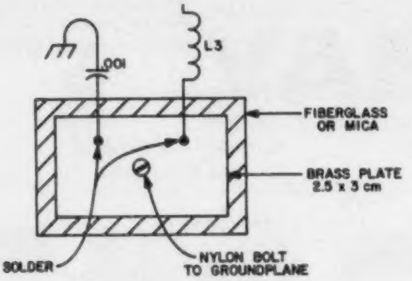

L3
.001
FIBERGLASS OR MICA
BRASS PLATE 2.5 x 3 cm
SOLDER
NYLON BOLT TO GROUNDPLANE

Fig. 2. Special UHF capacitor C7.

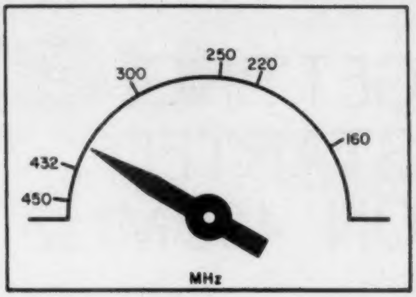

250
220
300
160
432
450
MHz

Fig. 3b. Front panel calibration for the wavemeter.

capacitors are mica compression Arco's, only three tapped coils, all base input capacitors are variable, no external bias needed on the two triplers, three similar transistors, HEP 75's, and only one special item, which requires a nylon bolt and nut.

Crystal Oscillator

This puts out enough power to drive the tripler base without external dc bias. Rf voltage at 48 MHz is developed in L1, tuned by C1. Remember, it is much simpler to describe oscillators when they are already running, and this one always will be if you make it as shown. The rf voltage is fed back in phase to the crystal. This of course is the wrong phase for the base, but the crystal has – at any given instant – plus on one side and minus on the other, so the base receives the rf voltage correctly out of phase, resulting in good, powerful, stable oscillation. Both the crystal and the base input of Q1 are of low impedance so the match is continued with a tap down on L1 for the feedback connection. I usually tune up the oscillator with a two or three turn link out of L1 into a tuned diode receiver on 48 MHz, which in this case showed some 20 to 30 mW output.

The First Tripler

A trimmer, C2, couples 48 MHz energy over to the base of Q2 in sufficient quantity so that no external dc bias is needed. L2 and C3 are tuned to 144 MHz. Be very sure you are on 144 and *not* on 96 or 192! Again, use a tuned diode receiver and an absorption wavemeter or a dipper in the diode mode.

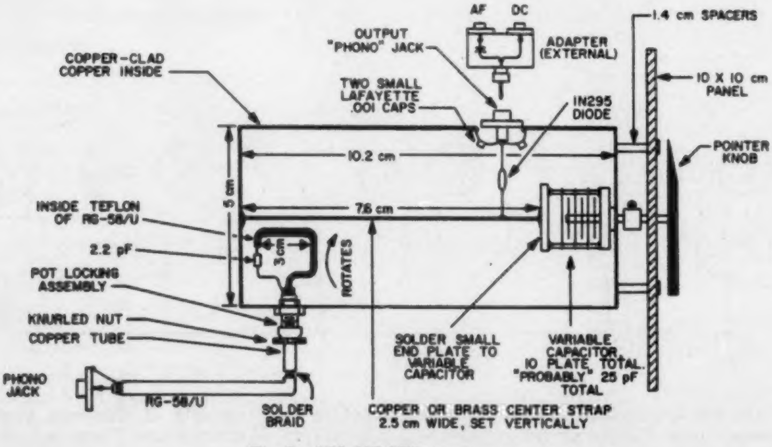

AF
DC
1.4 cm SPACERS
OUTPUT "PHONO" JACK
ADAPTER (EXTERNAL)
COPPER-CLAD COPPER INSIDE
TWO SMALL LAFAYETTE .001 CAPS
IN295 DIODE
10 X 10 cm PANEL
POINTER KNOB
10.2 cm
5 cm
7.6 cm
INSIDE TEFLON OF RG-58/U
2.2 pF
3 cm
ROTATES
POT LOCKING ASSEMBLY
KNURLED NUT
COPPER TUBE
PHONO JACK
RG-58/U
SOLDER BRAID
SOLDER SMALL END PLATE TO VARIABLE CAPACITOR
VARIABLE CAPACITOR, 10 PLATE TOTAL. "PROBABLY" 25 pF TOTAL
COPPER OR BRASS CENTER STRAP 2.5 cm WIDE, SET VERTICALLY

Fig. 3a. 150-470 MHz wavemeter.

Play around with C3 and L2, making sure it is on 144 MHz and that it does tune smoothly without discontinuous jumps and bumps, and that it does *not* affect the oscillator.

The Second Tripler, Q3

Almost the same story as the first. Just pay a little more attention to short leads and to the special capacitor you need for the collector return of Q3, C7. In order to have the +12 return lead of L3 properly bypassed to the baseboard ground so that 450 MHz energy circulates correctly around the C5-L3 circuit, I generally use a flat brass plate capacitor, insulated from the baseboard as shown in Fig. 2. This is a very useful type of capacitor to know about, especially if you are going up later to 1296 and higher. I also bypass the bypass with one or more tiny, ultra-short lead .001 capacitors from Lafayette. These even work (sometimes) at 1296. They keep lower frequencies from sneaking through C7. Don't forget there are plenty of these low frequencies lurking in the output of Q2, just waiting for a chance to show. Don't say I didn't warn you! Now you must have a good diode receiver and/or a good absorption wavemeter for 420–450 MHz. A friend of mine, 10 to 15 years in VHF, built a 432 MHz receiver and could not hear anything on the band for a week. No wonder – his L.O. was off one harmonic away from where it should have been! Figure 3 shows the exact dimensions of the diode receiver I use. I have used this one for years on 220 as well as on 420 to 450 and it is very reliable. With this handy piece of test equipment plugged into J1, the 450 MHz output jack, you should begin to get some output. Be sure and get 144 MHz energy into the base of Q3 via trimmer coupling capacitor C4. Then, by playing around with C5, L3, and C4 you should be able to build this up to a good ½V dc output from the diode receiver. With a 50 μA meter plugged into the output of this receiver, you can read nicely even small amounts of rf as it starts to arrive during the tuning. I usually put a 10K

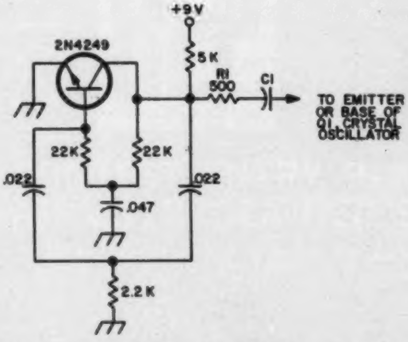
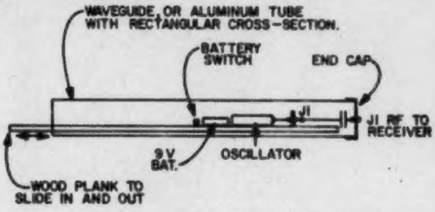


Fig. 4. AF oscillator modulator. The frequency is about 400 Hz, as shown. Adjust R1 and C1 for modulation needed. Any good AF transistor may be used.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J1 RF TO RECEIVER
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Fig. 5. The infinite attenuator.

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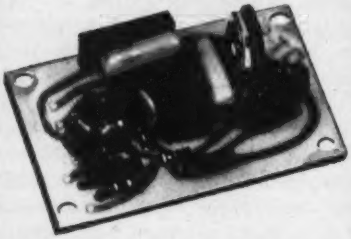

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pot in series with it, with calibration marks at .1, .5, 1..and 5V for handy use. Build up carefully the 450 energy, watching the 48 and 144 tuned circuits as you go. It's very easy for them to jump around if you use coupling that is too tight, via C2 and C4. I often use two or more tuned diode jobs to keep an eye on those lower frequencies. You can't be too careful. Always use only enough coupling capacitance to get maximum energy into the base concerned and no more. Even a little less than maximum for the smoothest and safest all-round best tuning. Do not leave this source in a marginal operation,jumpy, condition. Remember, you are the one who is going to depend on it to tune up your 450 gear. You could get more output by substituting a 3866 for the HEP 56 as Q3, the last tripler, but as this is intended only as a signal source, you don't really need it.

Modulation

A little tone, mixed FM and AM, never hurts in a signal generator, so a convenient little af oscillator plank is shown in Fig. 4. This can be connected between ground and the emitter of Q1, the crystal oscillator. Attach it to the base for more modulation through a resistor.

Infinite Attenuator

This one has been shown several times in *73*. Just mount the whole generator including the battery and switch on a long plank that will slide easily into a piece of aluminum waveguide or a piece of aluminum, rectangular cross-section, rain-gutter downspouting as shown in Fig. 5, and you can go down to a tenth or even a hundredth of a microvolt.

Conclusion

A simplified homebrew 450 MHz signal source has been described, along with a modulator and mention of an infinite attenuator. This could start you off on an interesting series of 450 projects planned to include receivers, transmitters and antennas. Don't forget, there are transistors available today with noise figures of 1½ dB at 500 MHz.

. . .K1CLL

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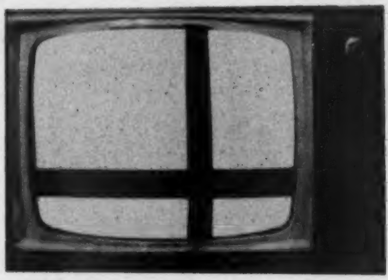


There are many ways to get on the air in ham TV. This article shows simple and graduated methods of transmitting TV. The first thing to have is a monitor. Then you can transmit your vertical and horizontal sync. Now you are on amateur TV. Next you can fill the picture with bars, dots, crosshatch, etc. If your resources are not too limited, you can build the simple flying spot scanner or a vidicon camera. This article shows the simplest ways to do these things with transistors; it is meant to be an idea article – to give you ideas on how to build up your station.

The Monitor "Jeep"

Of course you want to see your signal before you transmit it. The best way is to get an old TV set (no ac-dc models!) and disconnect the rf and video i-f, and connect your video output to the grid of the video amplifier. You can use the family set if you just insert a shorting phone jack between the detector diode and the grid. Then you can just plug in whenever you want. All you do is pull it out, and it's a TV set again. The signal level at this grid is compatible with the video output amplifier, generally 2V peak-to-peak, with negative going sync.

Sync Generators

Before anything can be done in video design, vertical and horizontal sync as well as composite must be available. The stability of the system is dependent on the quality of the sync generators. In simple, inexpensive designs many tradeoffs can be considered: random or interlaced scan, crystal control or free running, serrated vertical sync, color burst, blanking, etc. Many of these are elite, but more than necessary to the beginner. The use of complex frequency dividers and critical tuned circuits is eliminated by random interlace and multivibrators. Furthermore, the circuits lend themselves to integrated circuit techniques.

Vertical Sync

A 60 cps sine wave is derived from the power supply and squared off in Q1. The negative going edge of the square wave turns off Q2 for a time determined by $T = .7RC = 7\gamma\ (100{,}000 \times .02 \times 10^{-6}) = 1.4$ milliseconds for a standard 10:1 ratio of sync to scan time. The emitter followers give a low output impedance terminal capable of driving coax lines with 12V logic levels. The 2N3704 and 2N3702 are used for high gain at low cost.

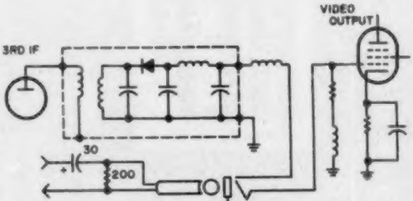


Fig. 1. An old television set can be used as a monitor by tapping into the grid of the video amplifier.

Horizontal Sync

Digital techniques here can eliminate tuned circuits and unstable blocking oscillators. A simple multivibrator is set to produce

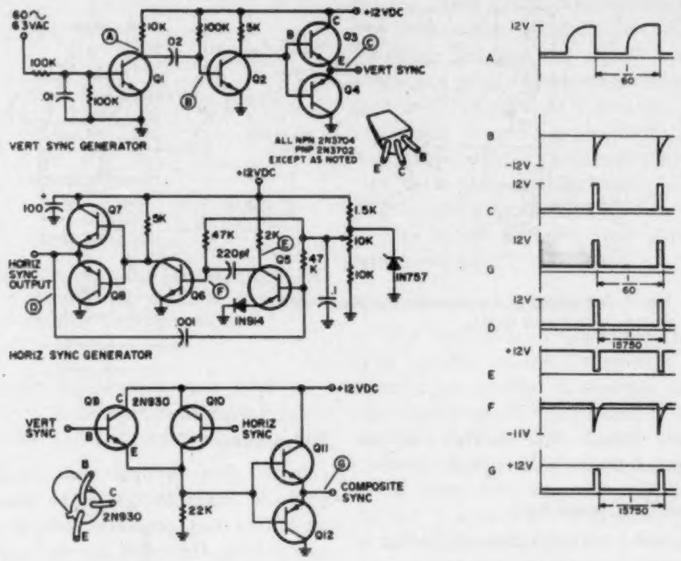

60~
6.3VAC
100K
.01
100K
A
10K
.02
100K
5K
B
Q1
Q2
Q3
Q4
C
E
B
C
+12VDC
VERT SYNC
VERT SYNC GENERATOR
ALL NPN 2N3704
PNP 2N3702
EXCEPT AS NOTED
E
C
B
+12VDC
100
Q7
5K
47K
2K
E
220pf
Q5
47 K
1.5K
10K
10K
1N757
HORIZ SYNC OUTPUT
D
Q8
Q6
F
1N914
.001
.1
HORIZ SYNC GENERATOR
Q9
C
2N930
Q10
+12VDC
VERT SYNC
B
E
HORIZ SYNC
Q11
G
COMPOSITE SYNC
B
C
2N930
E
22K
Q12
12V
A
1/60
B
-12V
12V
C
12V
G
1/60
12V
D
1/15750
+12V
E
F
-11V
G
+12V
1/15750

Fig. 2. Sync generator circuitry and representative waveforms at the test points.

a ratio of 7:1 scan to sync time. This is lower than the standard 10:1 ratio, but is more stable at starting and requires less deflection power. The time intervals are also determined by T = .7RC, but are significantly variable by the 10K "frequency" potentiometer. This zener regulated variable voltage gives stable protection against line voltage changes, and allows precise setting to 15750. The frequency range available is actually 11 to 18 kHz. The emitter follower pair serves two purposes in this circuit: both as a line driver and a signal squarer. Normally the collector resistor and the capacitor connected to it limit the voltage rise time, and an unsymmetrical wave often never squares off at the top. The emitter follower pair squares it off. The diode in the emitter of Q5 prevents excessive reverse breakdown currents in the base.

The composite output is generated by "or"ing the vertical and horizontal sync pulses in 2N930 Q9 and Q10. The 2N930 was chosen for its high gain, so that it would cause little load and the horizontal oscillator would not pull during vertical sync and

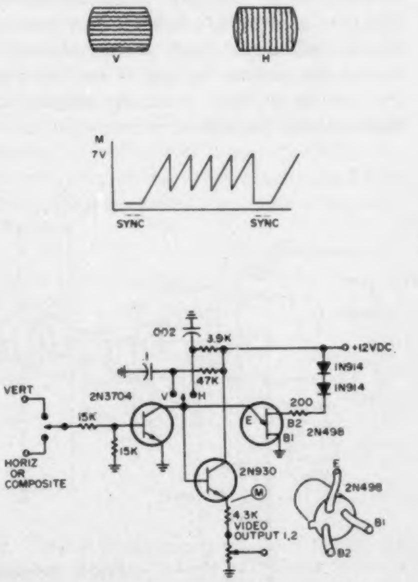

V
H
M
7V
SYNC
SYNC
.002
3.9K
+12VDC
.1
47K
1N914
1N914
VERT
2N3704
V
H
200
15K
E
B2
2N498
B1
15K
HORIZ OR COMPOSITE
2N930
M
4.3K VIDEO OUTPUT 1,2
E
2N498
B1
B2

Fig. 3. Vertical and horizontal bars can be generated with this circuit for checking sweep linearity.

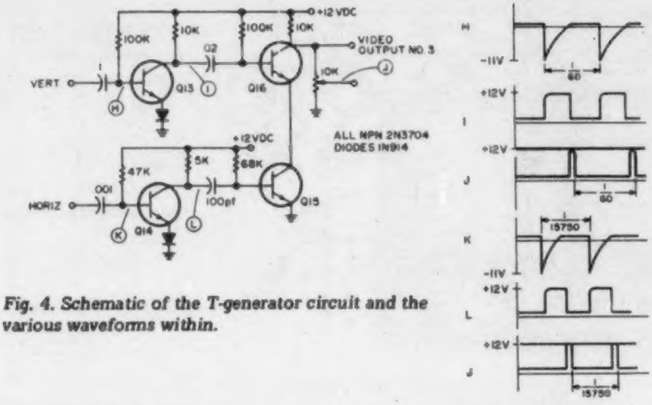

+12 VDC
100K
10K
100K
10K
VIDEO OUTPUT NO. 3
.02
.1
VERT
Q13
Q16
H
I
J
10K
+12VDC
ALL NPN 2N3704
DIODES IN914
47K
5K
68K
.001
100pf
HORIZ
Q14
Q15
K
L
H
-11V
1/60
+12V
I
+12V
J
1/60
1/15750
K
-11V
+12V
L
+12V
J
1/15750

Fig. 4. Schematic of the T-generator circuit and the various waveforms within.

cause severe "tear." The emitter follower pair was again used for a line driver.

Vertical and Horizontal Bars

Vertical and horizontal bars are useful in checking sweep linearity. A unijunction with emitter follower gives the entire gray scale in between bars and thus helps adjust modulation percent. This circuit is easy to adjust, since the rc time constant sets the number of bars per frame with sync from the appropriate sync generator to lock the bars in place. The 70 kHz upper limit of the unijunction limited the pattern to only 5 vertical bars. The diodes in base 2 of the unijunction improve ramp linearity.

T Generator

Now that vertical and horizontal are available, many things can be done. Locked oscillators can generate vertical and horizontal bars. Oneshots can shift signals from one side of the screen to the other. Pictures can be turned off and on.

The negative edge from the horizontal and vertical sync turns off Q13 and Q14 respectively for an RC time constant which then come back on. When these turn on, they turn off Q15 and Q16 for a very short time. When either turns off, the collector voltage of Q16 goes up, and this is the video output terminal.

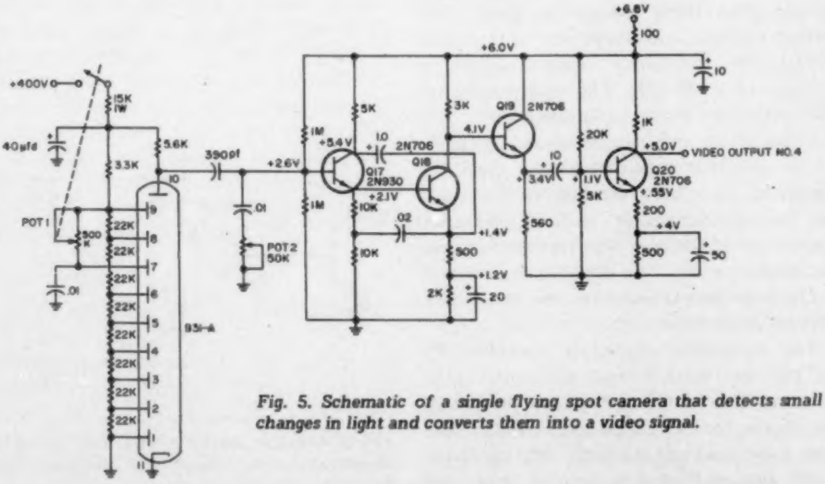

+6.8V
100
+6.0V
10
+400V
15K 1W
40μfd
3.3K
5.6K
390pf
10
+2.6V
1M
5K
+5.4V
1.0
2N706
Q18
Q17
2N930
+2.1V
10K
.02
1M
.01
POT 2 50K
POT 1
500 K
22K
9
8
7
6
5
4
3
2
1
11
931-A
.01
3K
Q19
2N706
4.1V
20K
1K
+5.0V
VIDEO OUTPUT NO.4
Q20
2N706
+.55V
10
34V
11V
5K
560
200
+4V
500
50
+1.4V
500
+1.2V
2K
20
10K

Fig. 5. Schematic of a single flying spot camera that detects small changes in light and converts them into a video signal.

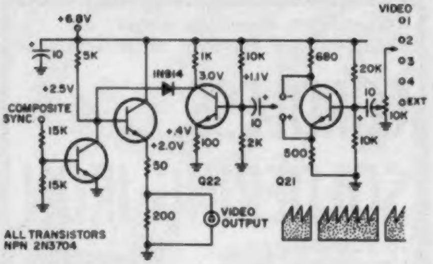
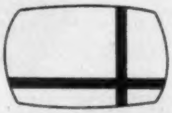


Fig. 6. The video output stage adds the composite sync signal to the video and produces a 1V signal suitable for modulating low powered rigs.

By delaying the vertical sync pulse approximately ½ frame and delaying the horizontal ½ scan, then adding the signals, we get this:



The circuitry is simple, and the signal is eye-catching as well as good for aligning the rig.

Flying Spot Scanner

Patterns are fine, but it is also desirable to transmit "live." A camera requires expensive tubes and deflection circuits which are difficult to make work properly. Worse yet, there are so many knobs to adjust. A flying spot scanner can transmit live using a TV set to scan across the image. The sync information can be transmitted to the set on an unused channel or jeeped into a monitor (connected to the set after the video detector). The TV set scans a white raster; the image (crayon or electrical tape on Saranwrap) cuts off the light. A light sensor picks up the variations in light. No available semiconductors could respond fast enough to high frequency video, so a photomultiplier tube was used. With this method, no lens system is needed. Pot 1 adjusts the sensitivity of the tube. Too sensitive, and the edges of the pictures are dark; not sensitive enough and no picture. Pot 2 compensates for the finite decay time of the phosphors which shows up as smear on the set. While adjusting this pot the signal level will go down and must be companesated in Pot 1. Q17 and Q18 form a "bootstrap" amplifier; a method of getting constant high input impedance at high frequencies with transistors. Q18, Q19 and Q20 make a wideband video amplifier with *no* coils.

This is the thing for test patterns, call letters and calling CQ.

Video Output Amplifier

The final step of the video chain is the sync inserter. In this design Q21 is a phase inverter for positive or negative video. Q22, the final stage of amplification, drives Q23 emitter follower for a low output impedance. Q24 and the diode in its collector insert composite negative going sync. The output is standard 1V negative going sync suitable for modulating a low power rig and the monitor.

The TV Transmitters

The remainder of the video system includes the aural carrier, generator, and the UHF transmitter. It may also be necessary to monitor video without a direct connection to the monitor. A channel 3 transmitter is described which operates on standard 1V peak-to-peak negative sync, and can be placed anywhere in the line. A channel 10 or channel 11 transmitter is also described for use with the flying spot scanner described earlier. Its purpose is to transmit composite

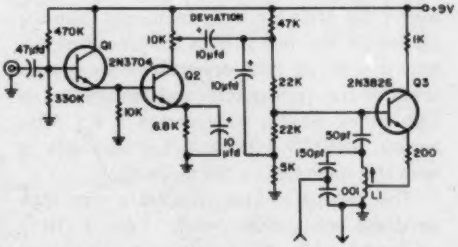


Fig. 7. Aural carrier generator. The 4.5 MHz FM output of this circuit can be mixed with the video signal for simultaneous transmission of both audio and video information. L1 – 50 turns, 2 strands of No. 36 in parallel on 3/8 in. (std) slug tuned form. Tap is 20 turns from ground.

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sync information to the scanning source TV set. With little modification it could be used as a video transmitter. The major goal to the ham radio operator is to transmit the video information in the 435 MHz region. Two UHF oscillators are discussed with their pros and cons and problems.

The Aural Carrier Generator

There are two ways of transmitting audio with video. One method is to have a transmitter 4.5 MHz higher in frequency than the carrier of the video; then frequency modulate it with 25 kHz deviation. This system requires two transmitters and two antennas. The other way is to generate a 4.5 MHz carrier with 25 kHz deviation and mix it with the video before the modulator.

The second system requires a very high deviation to carrier ratio: 5.56×10^{-3}, compared with $.75 \times 10^{-3}$ for commercial FM, and $.1 \times 10^{-3}$ for narrow band FM. Once generated it can be mixed with the video on the 1V peak-to-peak line requiring only .1V for the standard 10% video to audio ratio.

This circuit uses a Darlington amplifier for a high impedance microphone, and a conventional Hartley oscillator modifier for wide frequency modulation. Frequency modulation is accomplished in this oscillator by changing the interelectrode capacities of the transistor Q3.

The Composite Sync Transmitter

For the flying spot scanner, a TV set must be "in sync" to generate a scanning raster. A simple off-on transmitter will do the job, being on during sync and off during

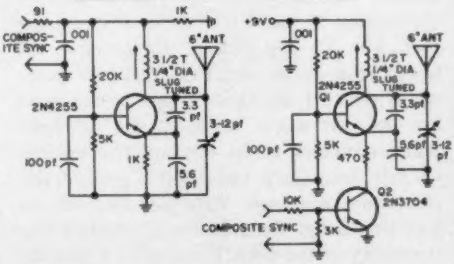

Fig. 8. Two simple composite sync transmitter circuits.

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scan. The frequency can be adjusted to any unused channel. In this case, it was adjusted in between channel 10 and channel 11 to avoid interference.

Circuit #1, the original circuit, is a flea power oscillator, deriving power from the composite sync terminal. This circuit caused several not too serious problems, however:

1. Time for capacitors to charge delayed sync and shifted resultant picture to the right. (This can also be caused by overscan in the scan source.) This can be overcome with very small bypass capacitors.
2. The slight difference in amplitude between horizontal and vertical sync caused the vertical and horizontal to be transmitted on different frequencies, making it hard to sync the TV set.

These problems were solved with one more transistor as shown in circuit #2. The lower emitter resistor allows it to oscillate at higher power. Constant voltage on the collector keeps the frequency from shifting. The transistor Q2 turns the transmitter off

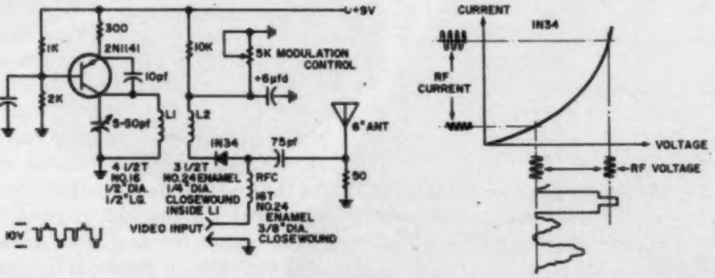

Fig. 9. A monitor transmitter for channel 3. See text for details on adjusting the modulation control. Modulate this circuit with Fig. 6.

and on, and since there is no capacitive load in the composite sync signal path, the sync signal is not delayed, and the picture is not shifted.

Monitor Transmitter Channel 3

This transmitter uses the same basic oscillator as the channel 10 sync transmitter. Operating with a 70 mW carrier the germanium diode is biased into conduction with current from the standard video line. As current in the diode increases, its resistance goes down and passes more rf to the antenna. As current decreases, the diode goes toward "cutoff" and doesn't conduct the rf voltage (see graph). The potentiometer is adjusted near the maximum voltage or white level and thus gives 100% modulation. This transmitter can be placed on the video line but is not a termination, so another monitor transmitter can also be on the line.

The UHF Transmitter

This simple 6J6 UHF oscillator works quite well as a low power transmitter in the UHF region. Standard video (1V negative sync) is ac coupled to the cathode for cathode modulation. It was the first one I had tried in the UHF band without the use of an antenna. The plate lines were 7.5 cm long. When the length of the plates and wires inside the tube and the length of the capacitor are added to the length of the lines, we have approximately a half-wavelength, which determines the frequency. Wave phenomenon are noticeable, providing the lines act as transmission lines. In the dark a pencil draws little sparks at each end of the lines and pulls the frequency down considerably, indicating voltage maximums. The center, however, can be touched with a screwdriver and frequency doesn't change, indicating a voltage null. The rf chokes are tapped here. Of course amateur radio license allows TV transmission in the 450 MHz band, and 11.5 cm lines are used then.

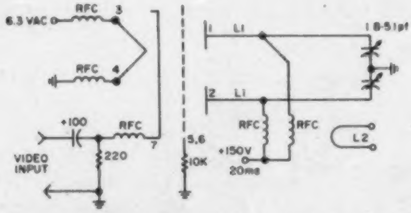

Fig. 10. A UHF oscillator that can be used as a low power transmitter. The video signal can be obtained from the circuit in Fig. 6. RFC-15T No. 24, 3mm diam. Channel 20, L1 – 7.5cm, No. 14 brass, spaced 16mm, tap at 25mm from tube. 435 MHz, 11.5cm No. 14 brass spaced 20mm, tap at 38mm from tube. L2–5cm No. 16, near L1.

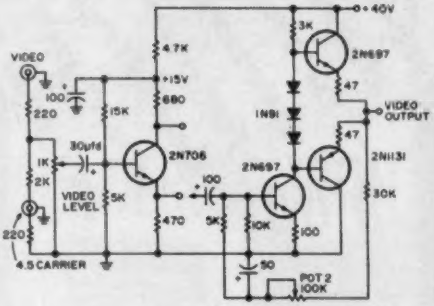

Fig. 11. A video modulator for driving higher power transmitters. It can be driven by the circuits in Figs. 6 and 7.

The circuit is actually a push-pull tuned plate oscillator, whose feedback is plate to grid capacitance.

High Power Modulator

For modulating the grid or cathode of a high power oscillator, a larger voltage swing and a lower output impedance is necessary. The circuit shown here can develop a 35V swing, and is also a convenient place to mix the audio carrier with the video. The transistors are chosen for high gain, high voltage, and high frequency response. The phase inverter was used so that both grid and cathode modulation could be tried, because grid modulation requires positive going sync, and cathode modulation requires negative sync. The emitter follower pair is biased properly for rather small idle current and no crossover distortion, by diodes, and is used for the low impedance output. The potentiometer Pot 2 is adjusted to make the voltage at the output terminal 20V. Audio is mixed with the video at the input so that the video to audio ratio is constant.

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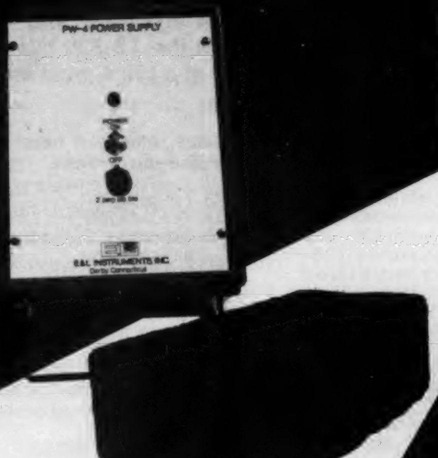
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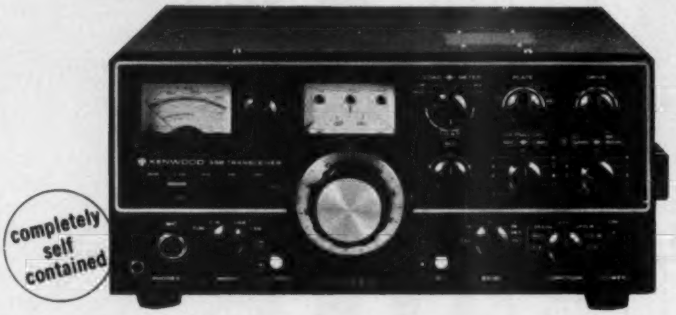

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Give your batteries a chance to say "Ouch".

With the influx of QRP battery operated rigs into the list of station equipment, batteries, particularly nickel-cadmium, are becoming ever popular as the power source. Ever since Motorola made their reject and surplus portable transceivers available to hams, and Drake, Standard and many others came out with portable 2m FM gear, more and more ni-cads have found their way into the hands of amateurs.

Many circuits for charging these batteries are available, including the newer "rapid charge" types, so there is no need to dwell on this topic. The problem many have encountered is when to stop talking and put the battery in the charger. Nickel-cadmium cells, unlike zinc-carbon and other types of batteries, do not show a steady decline in voltage as they are used, but rather a relatively constant voltage until the bitter end when they are just about completely discharged. If they are discharged further *permanent* damage will result. This can be very expensive – expecially in the case of the rapid-charge batteries used in Motorola equipment. It seems that some sort of battery voltage monitor is in order. The size restrictions imposed by the ultra miniaturization of the portable rigs preclude any meter that is available, and besides a meter would not act as a suitable warning device. What is needed is a definite alarm which tells the user "It's time to shut up, NOW." After some thought on the subject, the following solution was tried and found to be highly successful.

The Signetics NE555 chip was intended for use primarily as a timer and oscillator used in conjunction with TTL logic, but I have found its performance leaving something to be desired in these applications; however it does contain two very sharp comparators and a power stage as well as a flip-flop which seems to fill the bill for the battery monitor very nicely. Since the chip contains just about everything needed, only a few external components are required to sense the battery voltage with a resolution better than .2V. When coupled to an indicator of some sort, the whole unit takes up little enough space to be placed inside a rig as densely packed as an HT100.

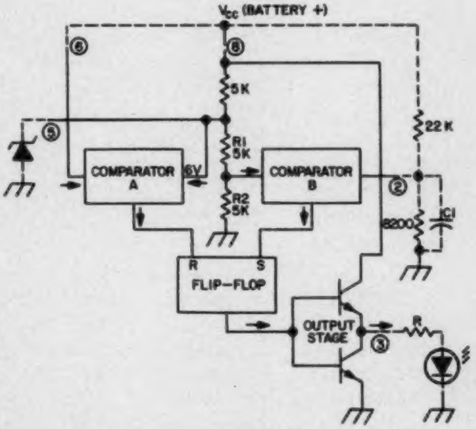

Fig. 1. Functional block diagram of the Signetics NE555 used as a voltage monitor. (External parts shown in phantom.)

A functional diagram of the device, shown in Fig. 1, shows the two comparators, a flip-flop and a power stage. One input of each comparator is tied to a reference voltage generated by the zener diode. The zener holds this voltage constant at 6V for comparator A, and 3V for comparator B (the internal 5000Ω resistors divide the six volts in half). Another 5000Ω internal resistor provides bias for the zener allowing

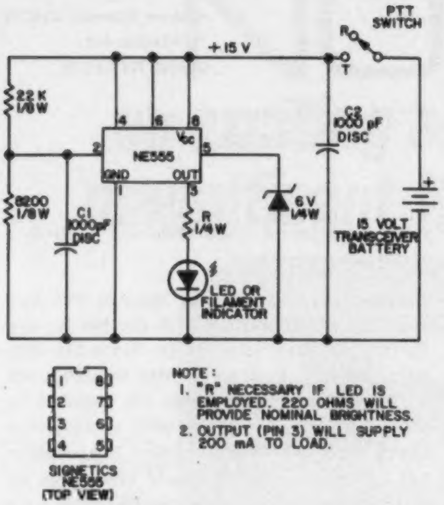
PTT SWITCH
R
T
+15 V
22 K 1/8 W
8200 1/8 W
C1 1000pF DISC
4
6
8
2
5
1
3
NE555
Vcc
GND
OUT
R 1/4 W
6 V 1/4 W
C2 1000 pF DISC
+
15 VOLT TRANSCEIVER BATTERY
LED OR FILAMENT INDICATOR
1
2
3
4
8
7
6
5
SIGNETICS NE555 (TOP VIEW)
NOTE:
1. "R" NECESSARY IF LED IS EMPLOYED. 220 OHMS WILL PROVIDE NOMINAL BRIGHTNESS.
2. OUTPUT (PIN 3) WILL SUPPLY 200 mA TO LOAD.

Fig. 2. The schematic of the voltage monitor.

between one and two mA to flow through the zener. The input to comparator A is connected to the battery voltage keeping its output high and resetting the flip-flop. As long as the input to comparator B is higher than 3V, both flip-flop inputs are high, and the output at pin 3 is low (ground). When the battery voltage drops below the threshold set by R1 and R2 (12V, in this case), comparator B output goes to ground setting the flip-flop and causing the output at pin 3 to go high. This output stage consists of two transistors in a totem pole configuration so that the device can supply high current as well as sinking current to ground. One of these transistors (only one) will be conducting at all times, and the chip is capable of supplying or sinking up to 200 mA. In this case it was found convenient to supply current to a load.

Almost any sort of indicator may be used; I found one of the tiny LEDs available from Industrial Devices to be very satisfactory. These are available in either red or green and are small enough to fit in the most compact rig. I mounted mine in the front cover of my HT220 just above the speaker grill so that it is just at eye level when transmitting. There is no current limiting within the NE555, so an external series resistor is necessary if an LED is employed. If a filament type lamp is used this is not required. A small buzzer or even another NE555 used as an oscillator could be powered by the unit if space permits and an audible alarm is desired. The point at which the lamp will light is determined by the voltage applied to pin 2. This can be set by a fixed external divider (as shown on the schematic) or by a pot. I found that fixed resistors were more stable. The values given are for a 15V battery and will cause the warning light to go on when the voltage reaches about 12V. If a different battery is used, set the firing point to about 3/4 of the fully charged voltage. Capacitor C1 is required for an rf bypass and to prevent internal oscillation. C2 is another rf bypass; a larger value might be required for lower frequency operation on 10m or below.

The static current drain (light off) is about 12 mA. Since the battery voltage will show the biggest drop during transmit periods, the monitor should be connected across the transmit supply only (so as not to drain the battery during receive operation).

If room permits, a small PC board could be used, but in my rig there was precious little room available, and the entire assembly was mounted over the i-f amplifier IC in the HT220 slimline. The circuit was constructed by soldering the zener diode and the resistors between the pins of the NE555 chip. The LED was mounted over the speaker and the speaker ground was used for grounding the cathode of the LED. A drop of silicon rubber was used to secure the LED to the front. A note of caution – many LEDs have their anode connection as the outside case so that insulating will be necessary if a metal panel is used.

In use the battery monitor lets you know when your battery is getting close to requiring a charge too. Ni-cads will recover somewhat from a long, high current drain and after a minute or two of steady talking the light may come on to let you know it's time to let the battery rest for awhile. As the battery gets weaker this period of time decreases. When the light comes on almost immediately after pushing the PTT button it's time for the charger.

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Kit HW-202, 11 lbs., mailable 179.95*
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Kit HWA-202-1, AC Power Supply, 7 lbs. 29.95*
Kit HWA-202-3, Mobile 2-Meter Antenna, 2 lbs. 17.95*
Kit HWA-202-4, Fixed Station 2-Meter
Antenna, 4 lbs. 18.95*

HW-202 SPECIFICATIONS — RECEIVER — Sensitivity: 2 dB SINAD* (or 15 dB of quieting) at .5μv or less. **Squelch threshold:** 3μv or less. **Audio output:** 2 W at less than 10% total harmonic distortion (THD). **Operating frequency stability:** Better than ±.0015%. **Image rejection:** Greater than 55 dB. **Spurious rejection:** Greater than 60 dB. **IF rejection:** Greater than 75 dB. **First IF frequency:** 10.7 MHz ±2 kHz. **Second IF frequency:** 455 kHz (adjustable). **Receiver bandwidth:** 22 kHz nominal. **De-emphasis:** –6 dB per octave from 300 to 3000 Hz nominal. **Modulation acceptance:** 7.5 kHz minimum. **TRANSMITTER — Power output:** 10 watts minimum. **Spurious output:** Below –45 dB from carrier. **Stability:** Better than ±.0015%. **Oscillator frequency:** 6 MHz, approximately. **Multiplier factor:** X 24. **Modulation:** Phase, adjustable 0-7.5 kHz, with instantaneous limiting. **Duty cycle:** 100% with ∞ VSWR. **High VSWR shutdown:** None. **GENERAL — Speaker impedance:** 4 ohms. **Operating frequency range:** 143.9 to 148.3 MHz. **Current consumption:** Receiver (squelched): Less than 200 mA. Transmitter: Less than 2.2 amperes. **Operating temperture range:** –10° to 122° F (–30° to + 50° C). **Operating voltage range:** 12.6 to 16.0 VDC (13.8 VDC nominal). **Dimensions:** 2¾″ H x 8¼″ W x 9⅞″ D.

$$\text{*SINAD} = \frac{\text{Signal + noise + distortion}}{\text{Noise + distortion}}$$

. . . and here's 40 watts out for your 10 watts in

The Heathkit HA-202 2-Meter Amplifier works with any 2-meter exciter delivering 5-15 watts while pulling a meager 7 amps from any 12 VDC system. No additional power supplies are required. All solid-state components mount on a single circuit board for easy two-evening assembly. Manual shows exact alignment procedures using a VOM or VTVM. Connecting cable and antenna cable are included.

Kit HA-202, 4 lbs. 69.95*

HA-202 SPECIFICATIONS — Frequency range: 143-149 MHz. **Power output:** 20W @ 5 W in, 30W @ 7.5W in, 40W @ 10 W in, 50W @ 15 W in. **Power input (rf drive):** 5 to 15W. **Input/output impedance:** 50 ohms, nominal. **Input VSWR:** 1.5:1 max. **Load VSWR:** 3:1 max. **Power supply requirements:** 12 to 16 VDC, 7 amps max. **Operating temperature range:** –30° F. to +140° F. **Dimensions:** 3″ H x 4¼″ W x 5½″ D.

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. . . then there's this perfect 2-meter tune-up tool

The Heathkit VHF/SWR Bridge tests transmitter output in power ranges of 1 to 25 watts and 10 to 250 watts ± 10% of full scale. 50 ohm nominal impedance permits placement in transmission line permanently with little or no loss. Built-in SWR bridge for tuning 2-meter antenna for proper match, has less than 10-watt sensitivity.

Kit HM-2102, 4 lbs. 29.95*

HM-2102 SPECIFICATIONS — Frequency range: 50 MHz to 160 MHz. **Wattmeter accuracy:** ±10% of full-scale reading.* **Power capability:** To 250 W. **SWR sensitivity:** less than 10 W. **Impedance:** 50 ohms nominal. **SWR bridge:** Continuous to 250 W. **Connectors:** UHF type SO-239. **Dimensions:** 5¼″ W, 5³⁄₁₆″ H and 6½″ D, assembled as one unit.
*Using a 50 Ω noninductive load.

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VHF SCANNING MONITOR
SQUELCH
MANUAL
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OFF

One of the popular fads these days is monitoring the radio transmissions of the local fuzz, fire companies and ambulance services. In fact, the local official parties concerned have no difficulty locating the scene of the crime, fire or accident. . .there is usually a crowd of "monitor freaks" which have beaten them to the event. The scanning type receiver is most often seen, as the chance of missing any excitement is eliminated. Most monitors around seem to be primarily brands available at the friendly neighborhood CB equipment store. One of these receivers had been on my want list for quite some time but, as I already had a shack full of gear and needed another receiver as much as the Senate Watergate Committe needed another witness, especially a non-ham band receiver, it was far down on the list. However, as usually happens, a Heathkit ad caught my eye because being offered was a unit with a frequency range that would enable me to monitor the local FM repeater gang (146.94) in addition to the police in my area (155.79) and at a price that is considerably less than other comparable units.

The Heath GR-110 circuits are comprised of 29 transistors, 8 ICs, 17 diodes and a 7 segment indicator tube. The unit operates either from a 120V power source via a conventional transformer-rectifier-filter arrangement or directly from a 12V battery in a mobile installation. The receiver front end consists of two rf stages and a mixer, all of which are 40673 field effect transistors.

A feature of this monitor receiver is a "priority channel" which, if desired, will automatically take precedence over any other signal that is being received. For this purpose, a separate oscillator circuit, consisting of a 2N5232A and a X29A829, pulses the gating circuits and activates the priority channel crystal. If an rf signal is being detected on that frequency, the resultant voltage completes the gate logic and the receiver is locked on the priority channel as long as a signal is present, after which normal scanning is resumed.

Front panel pushbuttons allow selection or bypassing of any or all channels during the frequency scanning process, or a selector switch may be placed in the "manual" mode to continuously monitor one particular frequency. A "select" switch provides manual stepping to the desired channel or the scanning may be stopped by switching from auto to manual while the receiver is locked on a transmitted signal.

Assembly of the kit is facilitated by the use of three separate etched circuit boards and the usual Heath check-by-step assembly manual, which has improved over the years from a "Connect a 680 ohm resistor from N5 (S) to N7 (NS)" step on one page and an illustration on another page, to a combined step-with-arrow pictorial format that is easier to follow. However, after builidng Heathkits for twenty years, I've noticed that the usual paper bag full of resistors, capaci-

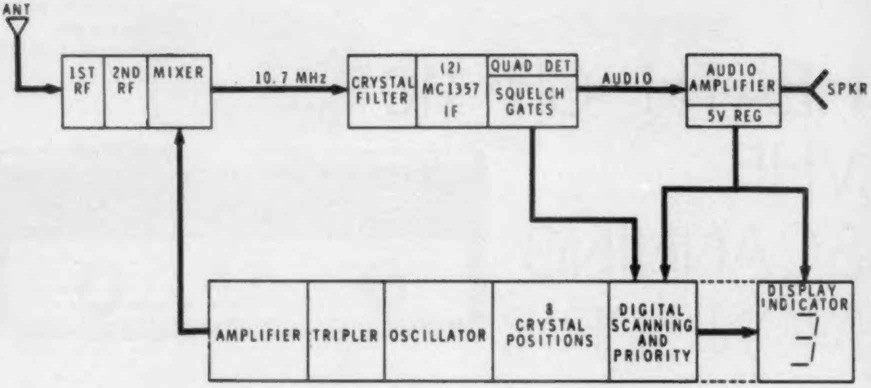
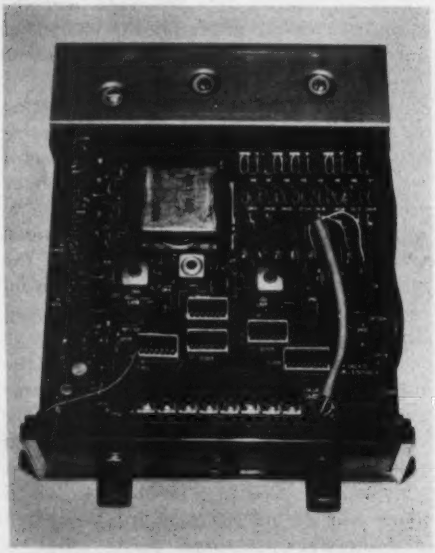


Fig. 1. Block diagram of the Heath GR-110 Scanning monitor.

tors, transistors and such has progressed (?) to a system wherein the bag and its contents are assigned a multitude of pack numbers, index numbers, Heath part numbers and the manufacturers part number. This may assist in some manner with Heath's inventory control or kit packaging process, but I personally feel that the inexperienced kit builder has enough problems without such numerical profusion.



The main circuit board contains the receiver front end (along left side), crystal oscillator circuitry (top right and center) and scanning circuitry (ICs at bottom).

The GR-110 is called a four-evening project. But, if you are a newcomer in the kit building world or are a Theodore Thumbs type, I recommend taking all the time that you personally require for a properly assembled unit. Good soldering techniques are a must. In fact, because I was trained in NASA methods of soldering, I went so far as to clean each circuit board foil pad and individual component lead prior to soldering, and cleaned the residual flux from the completed boards with alcohol upon completion. Also, I recommend the use of heat sinks on each transistor and diode lead while soldering. Alligator clips are fine.

Before the completed receiver can be aligned, at least one and preferably two, crystals must be installed. Crystals are *not* included with the kit, for obvious reasons. Heath does provide crystal certificates, at $4.95 each, which should be ordered at the same time as the kit, and upon receipt, filled out with your desired local frequency and mailed immediately, directly to the crystal manufacturer. Hopefully, the arrival of a crystal and the finish date of the kit will be concurrent. Also, your local parts supplier more than likely has a supply of the more popular frequency crystals for your area in stock.

Alignment may be accomplished with or without instruments. The instrument method requires the use of an FM signal generator capable of covering the desired frequencies and a VTVM. If these instru-

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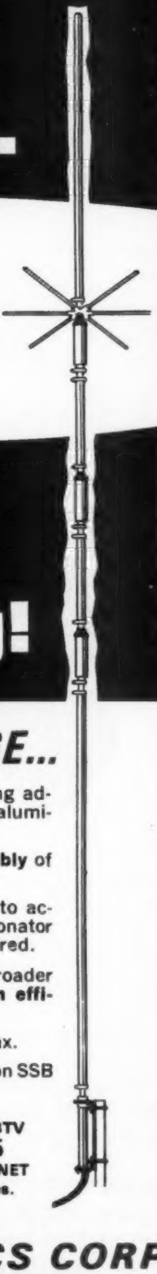

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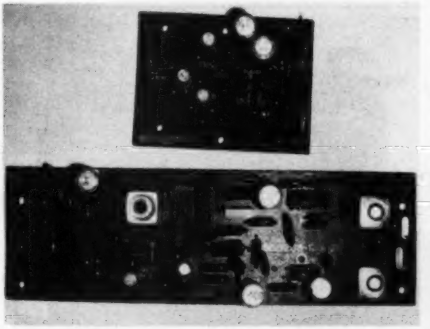
ments are not available, the monitor can be aligned with a simple one-transistor crystal oscillator signal generator kit that is furnished. This generator is very basically an upconverter and is a boot-strap operation in that it obtains its power from the receiver via an alligator clip, obtains an rf signal from the receiver l.o. tripler buffer with another clip, mixes this rf with its own 10.7 MHz oscillator output and feeds the resultant rf signal into the monitor's antenna jack. Using this method of alignment, with a high frequency and a low frequency pair of crystals installed for the desired scanning range of the receiver, was found to be entirely adequate for the type of reception normally expected.



The audio (top) and i-f section (bottom) occupy seperate pc boards.

Since completion, my GR-110 has been almost continually on, and it is somewhat satisfying knowing that I am not missing a thing that is happening around town.

Two modifications have been made to my unit already. First was the removal of the phono type antenna input jack and installation of a BNC type, which is more compatible with ham shack environs. Next, because I have on several occasions forgotten to turn off the squelched receiver prior to hitting the sack and consequently have been awakened by voices in the night, I installed a pilot light on the front panel.

Priced at $119.95, Heath's GR-110 Scanning Monitor is a worthwhile addition to any ham shack. . .and will cause you to wonder how you got along without one.

. . .W3WTO

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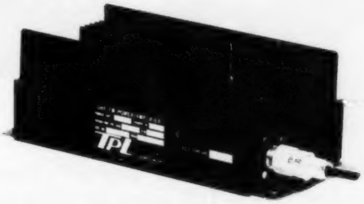

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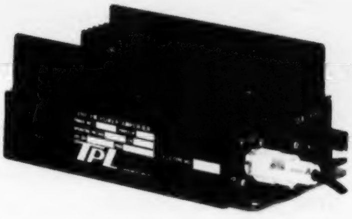

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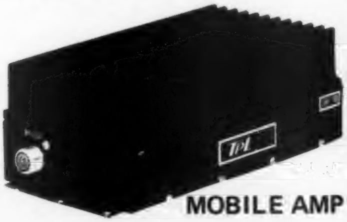

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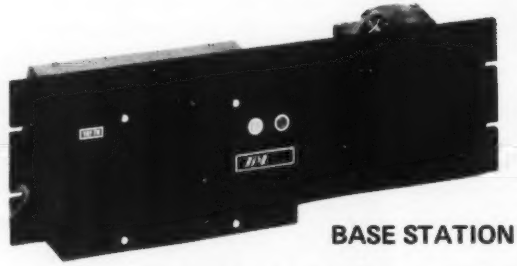

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PA3-1AB	.75-3W	20-25W	"
PA3-1EC	50-150mw	30-50W	"
PA3-1AC	1-5W	35-50W	"
PA3-1DC	6-15W	30-55W	"
PA3-1ED	50-250mw	60-80W	"

PART NO.	INPUT POWER	OUTPUT POWER	FREQUENCY RANGE
PA3-1DD	5-15W	60-80W	136-175MHz
PA3-1EE	50-250mw	80-120W	"
PA3-1AE	.75-3W	80-120W	"
PA3-1DE	5-15W	80-120W	"
PA6-1DE	1-4W	20-30W	400-512MHz
PA6-1AD	4-10W	25-35W	"

FCC type accepted for operation under parts 21, 81, 89, 91, 93, 95. Meets FCC specification: Part 5, subpart C, paragraph 5 103 (a).

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6M*	TPL 2006	50-54MHz	10Watts	220Watts	$270.00
2M	TPL 152	144-148MHz	1Watt	12Watts	$ 59.00
2M	TPL 302	144-148MHz	1Watt	30Watts	$ 93.00
2M	TPL 502B	144-148MHz	1Watt	50Watts	$130.00
2M	TPL 802B	144-148MHz	1Watt	90Watts	$195.00
2M	TPL 1202B	144-148MHz	1Watt	120Watts	$239.00
2M	TPL 502	144-148MHz	10Watts	45Watts	$113.00
2M	TPL 802	144-148MHz	10Watts	90Watts	$191.00
2M	TPL 1202	144-148MHz	10Watts	120Watts	$228.00
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440MHz	TPL 300B	420-450MHz	1Watt	25Watts	$190.00
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10M	TPL 5010	14-30MHz	100Watt FM 150Watt PEP SSB		$169.80
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Installation couldn't be more simple. Outwardly, "Cloverleaf" is a small black box that connects between your existing 144 MHz FM transceiver and its antenna, also to the microphone and car 12 volt battery. You plug the 450MHz antenna into another receptable provided. SB-450TRC has no external tuning, no controls other than a switch that allows instant shift between the 144 and 450MHz ranges. No mods are necessary. **Your existing 144MHz transceiver remains intact.**

Transmitter-wise, SBE "Cloverleaf" is entirely **passive—draws no DC power yet delivers 40% of the RF drive at three times the frequency.** Example: 4 watts out on 450 MHz for 10 watts drive on 2 meters. This high efficiency frequency multiplication is accomplished by a power varactor diode in conjunction with multiple high Q tuned circuits. The 450MHz output is of course frequency modulated; overswing, due to frequency multiplication, being compensated by a fixed pad in the microphone circuit within the unit.

Receiver-wise, "Cloverleaf" has a front end with unity conversion gain that converts 450MHz band signals to I-F frequencies corresponding to 144MHz channels. Limiter, discriminator, output audio and loud speaker in the 2 meter transceiver continue to function in the usual manner.

Mobile wise, this all-solid-state transceiver is ideal—a compact box that can mount wherever space is available. "Cloverleaf" current drain is negligible.

Price-wise, this SBE high value/performance breakthrough represents worthwhile savings over the cost of a complete 450MHz transceiver with comparable characteristics. Truly, SBE has done it again!

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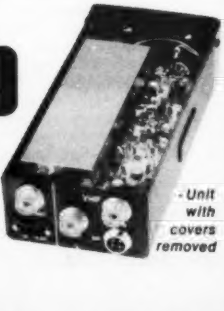

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AUTOPATCH INTERCONNECTION THE LEGAL WAY

Keep Ma Bell happy.

If you are presently operating an autopatch system or are planning to put an autopatch system on the air, it is felt this information will be of interest to you.

Voice communications equipment provided by you, the amateur and telephone company customer, may be electrically connected to the facilities of the telephone company system *only* through a voice connecting arrangement that is furnished, installed and maintained by the telephone company. This is described in state and interstate tariff regulations. In some states it is a criminal offense to make a direct connection to telephone company lines.

Today the equipment is available for just about any type of interconnection you might have need for. The big problem is communicating your needs to the telephone company marketing personnel. Most telephone company marketing personnel are not technically minded and do not understand what you, the customer and subscriber, might have in mind.

It is felt that the interconnecting devices described here are the best suited for autopatch operation. Which one you choose is determined by your particular needs. The C2A system is now being used with very satisfactory results and this information seems worth passing on.

These devices are known as Voice Connecting Arrangements C2A and SU6AQ. Technical references covering these arrangements are available from the American Telephone and Telegraph Company[1] as a guide for designers, manufacturers, and consultants of customer provided systems and

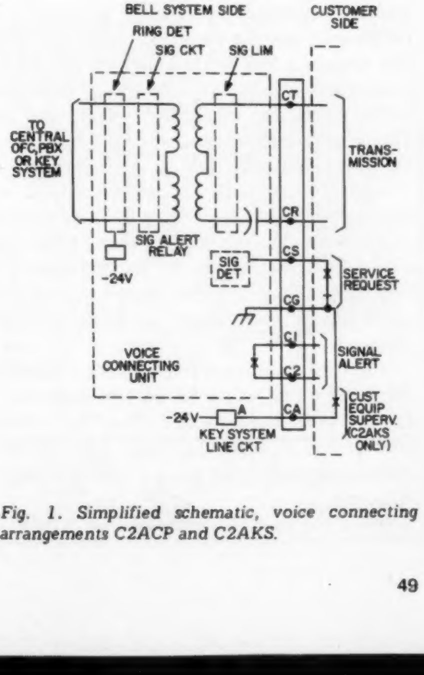
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Fig. 1. Simplified schematic, voice connecting arrangements C2ACP and C2AKS.

equipment which connects with Bell System communication systems.

Voice connecting arrangement C2A provides a bridged connection to a line terminated at a telephone company telephone set, typically for use with customer provided call extending equipment. The unit is an 8 in. printed board installed by the telephone company in a 23 in. relay rack or cabinet mounting. A 24V dc power supply is required and is provided by the telephone company. A non-switched, grounded, ac outlet providing 117V ac ±12V, 60 Hz, fused at 15A must be available at the installation location. The temperature range of the unit is 0° to 55° C, with a humidity range of 5 to 95%.

The voice connecting arrangement C2A provides at the interface connecting block the following leads with associated functions for the customer's use:

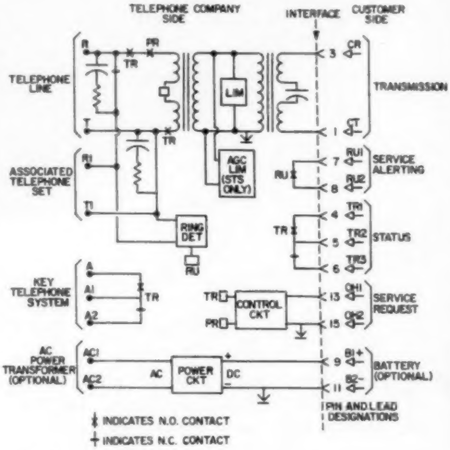
CT	Two way voice transmssion
CR	and tone signaling
CS	Service request, answer/disconnect,
CG	and dc dialing pulses
C1	Incoming ring
C2	signaling

The CT-CR leads provide a two-way audio patch between the telephone line and the customer's equipment. Duplex operation may be used. This includes any TOUCH TONE® signaling. This circuit is a nominal 600Ω and may be balanced or unbalanced. The insertion loss is 1 dB, 300 to 3000 Hz. There are several specifications for this circuit including maximum power level in dBm, audio frequency limitations and when used tone signaling levels and frequencies.

The CS-CG leads are normally open. A short of no more than 18Ω provides a means of answering an incoming call, and initiating a call. Dc dialing pulses are also transmitted over these leads. Further specifications include voltage and current on leads and dial pulse rate.

The C1-C2 leads provide a contact closure during the ring cycle of an incoming call. The closure is opened during the silent interval and is normally open. The load on these leads may not exceed 250 mA non-inductive.

Voice connecting arrangement SU6AQ and STS provides a means for automatically connecting customer provided equipment, capable of orginating and/or receiving calls, such as alarm systems, to the telephone network. An associated telephone company provided telephone set may be used to provide normal telephone service. Arrangement STS has all features of the SU6AQ and, in addition, permits the customer provided equipment to transmit answer back tones to the distant party through an agc system which assures compliance with network protection criteria (audio level).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T1
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A1
A2
TR
CONTROL CKT
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AC1
AC2
AC
POWER CKT
DC
+
−
3
CR
1
CT
TRANSMISSION
7
RU1
8
RU2
SERVICE ALERTING
4
TR1
5
TR2
6
TR3
STATUS
13
OH1
15
OH2
SERVICE REQUEST
9
B1+
11
B2−
BATTERY (OPTIONAL)
PIN AND LEAD DESIGNATIONS
INDICATES N.O. CONTACT
INDICATES N.C. CONTACT

Fig. 2. Simplified schematic, voice connecting arrangements SU6AQ and STS.

The arrangements consist of a printed circuit board housed in an apparatus box approximately 9 in. square and 3 in. deep, intended for wall or shelf mounting. Connection to customer provided equipment is made by means of a 15 pin female receptacle provided at the bottom of the arrangements. The customer must provide the mating plug (Cinch No.231-15-61-133 with hood No.239 -13-99-069). These arrangements will operate from a customer provided battery (18V @ 150–500 MaH) or from a 177V ac, 60 Hz, current regulated transformer supplied by the telephone company. For emergency power the battery may be floated across leads B1+ and B2-. A charging current of 2.5 mA is available while the unit is being operated on ac.

The voice connecting arrangements SU6AQ and STS provide on the customer provided cable leads the following:

CR	Two way voice transmission
CT	and tone signaling
RU1	Incoming ring
RU2	signaling
TR1	
TR2	Status
TR3	
B1+	
B2-	Battery

The CT-CR leads provide a two way audio path between the telephone line and the customer provided equipment. This includes TOUCH TONE® signaling. In addition, with arrangement STS these leads may be used to transmit and receive supervisory tones from the distant party. The insertion loss is 3 dB at 250 Hz and 1 dB over 300 to 3000 Hz. No voice signal amplification is provided. For design purposes the impedance should be considered to be 600Ω. There are several specifications for this circuit, including maximum power level in dBm, audio frequency limitations and when used tone signaling levels and frequencies. The agc limiter incorporated in the transmission path of arrangement STS is to protect the telephone network from application of abnormally high tone signals. It has no effect on normal speech levels.

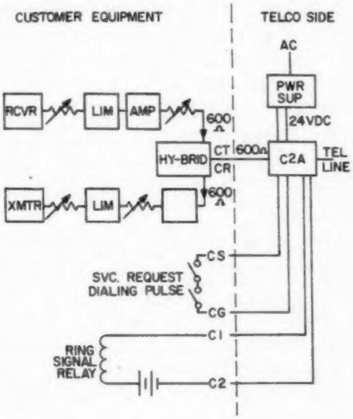

Fig. 3. Typical autopatch arrangement.

Leads TR1-TR2-TR3 provide isolated

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contacts to the customer provided equipment to indicate the status of the connecting arrangement. During line seizure, leads TR1-TR2 are shorted and leads TR2-TR3 are open. When disconnected from the line, leads TR1-TR2 are open and leads TR2-TR3 are shorted.

Leads B1+ and B2- provide for a connection to a customer provided dc power source for operating the arrangements. The telephone company may, at the customer's option, provide a power source for the connecting arrangement. The customer must specify which power source is to be used.

Arrangements SU6AQ and STS are normally isolated from ground and therefore customer provided signaling and power supply connections must be isolated from ground. No mention is made about grounding for arrangement C2A except that it is expected that the customer provided equipment will be grounded.

There are several additional specifications which you may need to know if you decide to use one of these units. The intent of this article is to provide information about what is available for interconnection between the telephone network and an autopatch so the amateur will have an idea what type of equipment to ask for to perform the functions desired.

There are several other Voice Connecting Arrangements available, each intended for a specific purpose and available only on certain types of lines. A Technical Reference Catalog which lists all arrangements, respective publication number, and a brief resume on each, is available from the American Telephone and Telegraph Company[1]

The cost of the mentioned arrangements is about $7 per month (varies with the area) and is well worth the investment, mainly – no more worry about what the telephone repairman might find if he unexpectedly visited your shack or transmitter location.

. . .W3YVV

Publication #40000, Technical Reference Catalog (free). Publication #42207, Arrangement C2A ($1.50 ea.). Publication #42210, Arrangement SU6AQ/STS ($1.50 ea.). Available from: American Telephone and Telegraph Co., Supervisor Information Distribution Center, 195 Broadway, Room 208, New York NY 10007.

William A. Hayes W2BSP
12 Schiller Street
Hicksville, L.I. NY 11801

FREQUENCY APERTURE MODULATION

Phase II

Being a radio amateur for over forty years has been a pleasure and I have seen many developments in the art. Much of my operating has been on the phone frequencies and my first love was AM on the old 80 meter band. AM is gradually disappearing and one rarely hears an AM station on the low frequencies. SSB has made a big hit as it permits voice communication in a much smaller segment of frequencies. It is ideal in this respect, but to an old AM lover it still doesn't seem to be best. FM is terrific but here again we end up taking twice as much space in the spectrum for voice transmission. Let's keep trying for a better system! My attempt is FAM or Frequency Aperture Modulation described below.

Before going directly into FAM it is most important to understand FM. A pure unmodulated carrier can be considered as having no bandwidth in the radio spectrum, yet it can be detected. Knowing that it is there, we can turn it on and off with a key and transmit code. This causes the radio frequency to evidence some bandwidth. If a receiver is very selective one can isolate the frequency quite well and receive the code. One way of looking at a carrier in the radio spectrum is the same as looking at the edge of a disc spinning in space. In Fig. 1a the disc looks like a very fine line. It is very difficult to see, like Saturn's ring when viewed edgewise. If we cause disc to wobble on its axis as in Fig. 1b, we can see it far better. We can compare this with AM Modulation. Now if we were to make the disc not only wobble on its axis but also cause the hub of the axis to move as in Fig. 1c we could say this is FM. (Bw represents band-

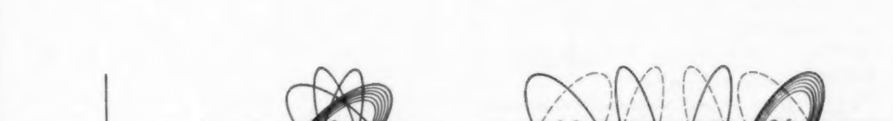

Fig. 1. W2BSP's disc analogy to describe modulation.

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width.) Note that the hub of the disc in the case of AM does not move and that in FM it does. This hub can be considered as the fundamental frequency of an oscillator. In AM we try to keep it in one spot of the radio spectrum. In FM we purposely move it and this motion is known as deviation. One of the first arrangements for generating FM was to use a condenser type microphone in an oscillator circuit so that the oscillator frequency was varied at voice frequencies. Deviation is a measurement of how far the frequency, or hub in this case, is moved up and down in frequency. In Fig. 1c, the movement in frequency would correspond to moving the hub from left to right and vice versa. An example would be to use a one cycle per second modulating signal and deviating the hub ±75,000 Hz in the radio spectrum, or a 1,000 Hz signal and deviating the same ±75,000 Hz. In narrow band FM the deviation is small and in FM broadcasting the deviation is very large.

When one frequency modulates a radio wave several things happen. If one modulates an FM broadcast carrier with a 1,000 Hz tone and watches the spectrum that is generated with a receiver that has a 500 Hz selectivity one finds individual radio frequencies every 1,000 Hz. They will vary in strength, but as many as 150 carriers can be detected if the deviation is a full ±75 kHz. All these radio frequencies, commonly called carriers, are generated by the movement of the radio frequencies beating against themselves as the fundamental frequency is swept up and down the radio spectrum. Each audio frequency takes on the same configuration and one finds that when voice or music modulate the carriers a very complex conglomeration of frequencies is generated. If one were to modulate the above mentioned FM broadcast with a 10,000 Hz signal, the total number of individual carriers would be spaced 10 kHz apart and we could detect only 15 individual carriers, assuming that we keep the deviation the same. With these 15 carriers and a system for modulating each, one could make 15 different narrow band FM stations. Stereo broadcasting is done in somewhat the same way.

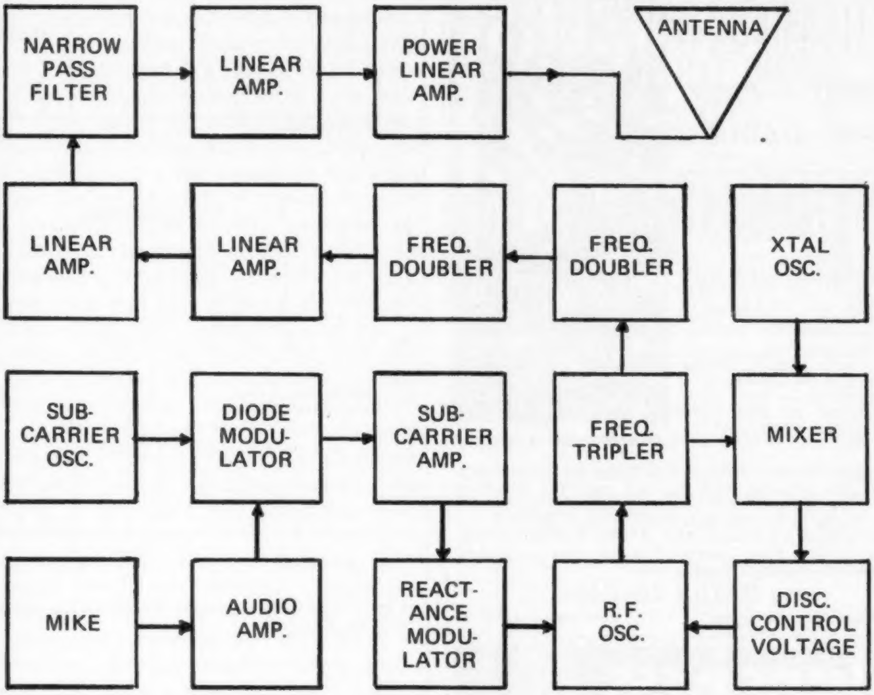
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Fig. 2. Frequency Aperture Modulation system.

To move now from FM and into Frequency Aperture Modulation, we know that the normal voice takes about three to four thousand Hz for good understanding. This means that the space in the radio spectrum required for voice will be the same and we have made good radio receivers that can vary a slot or aperture to that extent. Now that we can receive a 3 to 4 kHz signal let us experiment a little. Take two carriers spaced 1,000 Hz apart in the radio spectrum and tune the receiver so that those carriers fall within the receiver's bandwidth. One will detect a beat in the speaker as an audio tone of 1,000 Hz. If one separates the carriers to 3 kHz one gets a 3 kHz tone in the receiver. When one separates the carriers to 5 kHz nothing is heard as the bandwidth of the receiver cannot pass 5 kHz. If the receiver is tuned to one side of a wide-band FM station modulated by 1,000 Hz the effect is similar. If the FM broadcast station is modulated by a 5 kHz tone nothing can be heard. Note that when the FM broadcast station is not modulated no energy ever gets into the receiver because the carrier is off-side. The principle of Frequency Aperture Modulation is derived from this phenomenon.

The object in the FAM system is to generate a frequency modulated spectrum that contains all the voice information in a 3.5 to 4 kHz slot. The generation of a spectrum for FM broadcasting with good linearity requires a frequency modulated low frequency oscillator with its output multiplied till one gets the deviation required. In FM broadcasting large and small deviations are received because the FM receiver has a wide receiving bandwidth. A low amplitude signal that deviates say ±5 kHz is received as well as a high amplitude signal with a ±75 kHz swing and one sees that excellent

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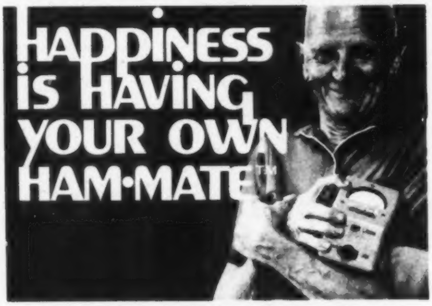

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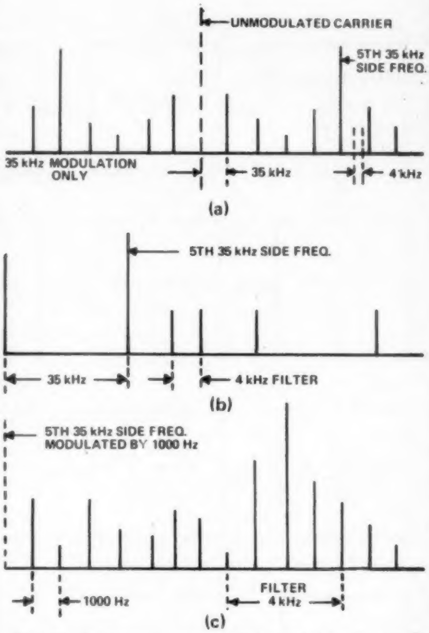

Fig. 3. Spectrum generated by sub-carrier amplitude modulation.

fidelity up to 10 or 15 kHz is possible. If one places the selective receiver to one side of the unmodulated FM broadcast carrier, say about 10 kHz higher, and then deviates the carrier ±5 kHz with a 1,000 Hz audio tone no audio is received: If one increases the deviation more than ±10 kHz the audio tone gets into the receiver. The Bessel-function analysis shows that as we vary the deviation or amplitude of the audio more or less signal will get into the selective receiver. Compressing the audio so that its amplitude varies less, and keeping the level constant, will help in getting more of the signal into the narrow band receiver. Clipping of the audio will also contribute to keeping the deviation constant.

Experiments show that the above mentioned control of the deviation by compression and clipping is insufficient to get fair quality signals in a narrow frequency range and it was decided to add a sub-carrier to the modulation. The sub-carrier amplitude modulated makes a spectrum that can be adjusted like a fine control. Most any frequency above the audio range and not too high in frequency will work. A frequency of 35 kHz was chosen because available parts on hand dictated this frequency. The spectrum generated is shown in Fig. 3a, b and c. The doubling, tripling, and final stages when tuned to the upper side frequencies peaked at the upper 5th side frequency. This meant that frequencies 175 kHz away from the unmodulated carrier were amplified and used. The amplitude of the 35 kHz was adjusted so that it peaked at the 5th upper side frequency. To facilitate the tests two high Q resonant cavities made of two 55 gallon drums were constructed and were made to tune in the 30 MHz amateur band. They were hooked in tandem to give a band pass of less than 35 kHz. Considerable rejection of the unwanted frequencies was obtained and it was also discovered that some ac hum modulation was giving erroneous readings. The filter was adjusted so that its aperture was between the 5th and 6th upper side 35 kHz sub-carrier frequencies as shown in Fig. 3a, 3b and 3c. All the equipment before the filter operated at low level and shielding minimized spurious radiations. A power amplifier using three stages at the filter frequency was used to amplify the output and it was possible to get about ten to fifteen watts into a dummy load. A very good modulation of voice frequencies was monitored some distance from the dummy load using a long coax line as an attenuator. Accuracy of measurements was limited due to lack of additional test equipment but the results were very convincing. With a few refinements of the equipment an excellent FAM system can be built.

Here is a system that suppresses the carrier and has all the capabilities of SSB. The interference between stations is minimal, as one is able to understand the two stations the same as two people talking at the same time even when slightly off frequency with each other. The output of the filter can be heterodyned with an oscillator making lower frequency operation possible. No on-the-air tests have been conducted due to the fact that the FCC has not yet given its approval.

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VERSATILE TEST EQUIPMENT RANGE EXTENDER

A simple, relatively inexpensive IC amplifier provides accurate and stable voltage gains of either 10 or 100. It can be used to easily extend the sensitivity range of various dc and ac test instruments with a simple scale change factor.

Many amateurs use relatively simple test instruments, such as inexpensive voltmeters, oscilloscopes, etc., for routine maintenance work and construction projects. Simple instruments properly used can suffice for a wide variety of projects. However, there occurs those situations where more sensitive test instruments are needed to take proper measurements. For instance, take the case of those VOMs with a 10V maximum deflection on the low range and a 10,000 (or less) Ω/V sensitivity. Such an instrument is difficult to use when dealing with the low bias voltages on many transistor stages. This is because of the difficulty in reading low voltages on the scale and because of the loading effect caused by the instrument's low equivalent resistance on the 10V range.

A similar situation might exist with an inexpensive oscilloscope where the input impedance is high enough but the deflection sensitivity is low. Rather than buy more expensive test instruments, the "expensive" features of which are only occasionally needed, or do a poor measurement job with the instruments available, it is very worthwhile to use an outboard amplifier, which can both extend the low range on an instrument and provide a very high input impedance.

This article describes such a simple instrument amplifier. There is certainly nothing new about dc meter amplifiers as such. However, the advent of IC operational amplifiers makes the construction of such a device particularly simple. Also, the IC amplifier is internally temperature-compensated, so its gain, once calibrated, will remain very stable under a variety of operating conditions – a very necessary quality if accurate instrument readings are to be obtained. Although some specific integrated circuits are mentioned, almost any operational amplifier can be used. The bandwidth and input impedance will vary with different amplifiers but these factors can be determined from a data sheet.

Figure 1 shows how the outboard amplifier functions when used with a simple VOM. It is placed between the test leads and the terminals on the VOM or other

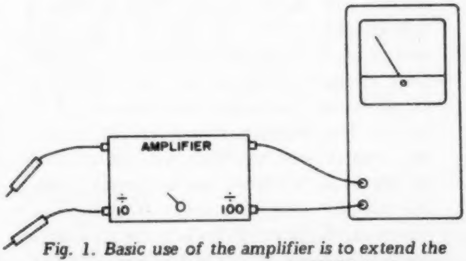

Fig. 1. Basic use of the amplifier is to extend the low voltage (ac or dc) range of a VOM. It also can provide a high input impedance to prevent loading of the circuit being tested.

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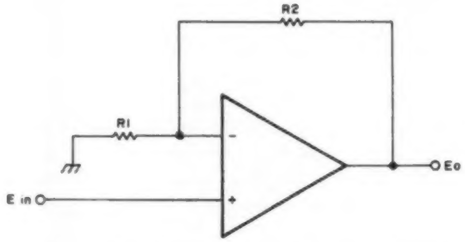


Fig. 2. Basic operational amplifier performance equations.

instrument. It can be used on *either* the ac or dc low range of the instrument. If the normal low range on the VOM is 10V, it will be changed to 1V when the amplifier switch is in the ÷100 position. A similar scale change will occur for any other low range on an instrument (e.g. 5V to 0.5 or .05V). The frequency response of almost any operational amplifier will match that of the usual VOM on its ac ranges where the response only extends to 20 kHz or so. However, if the amplifier is to be used with an oscilloscope or VTVM where the frequency response might extend to 1 MHz or more, an operational amplifier with corresponding bandwidth must be used.

Amplifier Circuit

The basic operational amplifier circuit is shown in Fig. 2. As shown in the figure, the gain of the amplifier (from dc up to the cutoff frequency of a specific amplifier) is determined by the ratio of the resistances. Therefore, by choosing and switching the resistors properly, one can produce an amplifier with specific gains for instrument reading expansion. Bypass and rolloff capacitors may be necessary for a specific amplifier to prevent spurious oscillations and to shape the frequency response.

Figure 3 shows a practical circuit using a Motorola MC1520 amplifier. The frequency response of this unit is quite broad – extending from dc up to 10 MHz. The circuit, however, is typical of that which can be used with other less-expensive operational amplifiers where such a high frequency response is not required. The input impedance is in the order of several megohms and the maximum input voltage that the unit can linearly amplify is ±3V. The amplifier

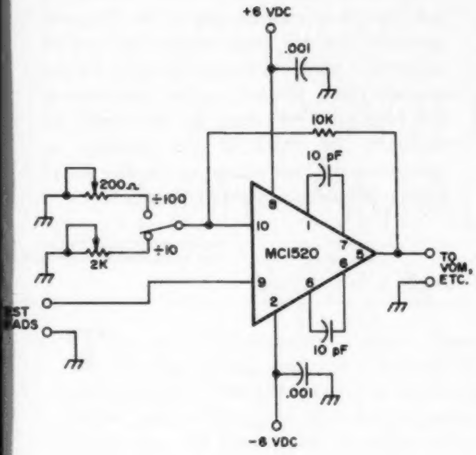

+6 VDC
.001
10K
10 pF
200Ω
÷100
÷10
2K
MC1520
8
10
1
7
6
5
9
6
2
TO
VOM,
ETC.
EST
ADS
10 pF
.001
-6 VDC

Fig. 3. The Motorola MC1520 general purpose operational amplifier can be utilized for extended measurements from dc to 10 MHz.

action is noninverting. That is, positive-going inputs cause a positive-going output, and negative-going inputs cause a negative-going output. So, when measuring a voltage one has to reverse the test lead connections in a conventional manner, depending upon the polarity of the voltage being measured. Two 6V batteries are needed to power the amplifier (a maximum 10 mA current requirement). The absolute maximum supply voltage which can be used is 9V.

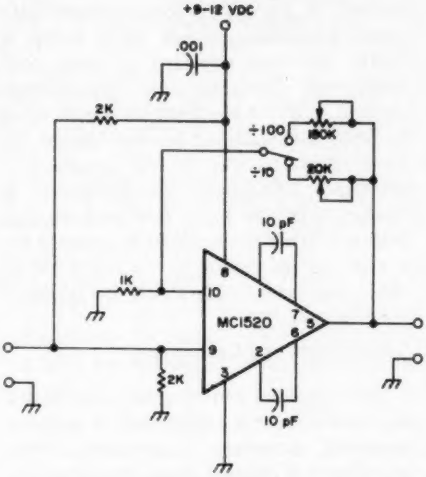

+9-12 VDC
.001
2K
÷100
180K
÷10
20K
10 pF
1K
8
10
1
MC1520
7
6
5
9
2
3
2K
10 pF

Fig. 4. One can rearrange the circuit of Fig. 3 so only a single battery is needed but the necessary bias arrangement reduces the input impedance.

Although the current drain is such that small transistor batteries can be used, one may want to use only a single battery. This can be done using the bias arrangement shown in Fig. 4. The amplifier operation remains the same as before but the necessary placement of a bias resistor from terminal 9 to ground considerably lowers the input impedance of the amplifier.

Another amplifier circuit is shown in Fig. 5. The frequency response extends to

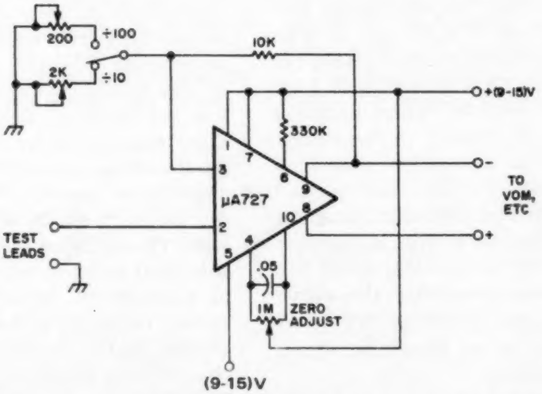

200
÷100
2K
÷10
10K
+(9-15)V
330K
1
7
3
6
9
μA727
8
10
2
4
5
TEST
LEADS
-
TO
VOM,
ETC
+
.05
1M
ZERO
ADJUST
(9-15)V

Fig. 5. Another example of the use of an operational amplifier for use as a calibrated gain amplifier. Input impedance for the unit used is an extremely high 1000 MΩ.

only a few hundred kilohertz. A unique feature of the unit is the extremely high input impedance (1000 MΩ) which is better than that provided by many FET voltmeters. The maximum input voltage range is ±10V. A dual battery supply must be used as indicated. Because of the internal characteristics of the amplifier, a separate zero-adjust potentiometer is needed. With the input test leads shorted together, the potentiometer is adjusted for a zero voltage indication on the VOM or other instrument with which the amplifier is being used.

Construction and Calibration

The amplifier can be easily constructed in a minibox or a plastic case. A shielded enclosure, however, is preferable if the amplifier will be used for ac measurements above a few hundred kilohertz. Otherwise, there are no special precautions to be observed in the construction of the amplifier. Naturally, lead dress should be carefully done on amplifiers used in the megahertz range. The calibration potentiometers need be only small, inexpensive PC board types (Mallory MTC) since they only have to be adjusted once for calibration purposes. The zero-set potentiometer shown in the circuit of Fig. 5 should be a panel control.

The calibrating potentiometers can be set by using a fresh battery as a calibrating source with a voltage divider network across it to produce the appropriate voltages. For instance, if 0.1V and 1V were required, a 1.5V battery could be used. For 1V, a divider of 1 kΩ in series with 2 kΩ could be used with the voltage measured across the 2 kΩ resistor. A low-voltage battery should be used (rather than a 9V battery) to obtain 0.1V in order to avoid errors due to divider resistance tolerances.

If an amplifier circuit with a low input impedance is used, such as that of Fig. 4, a divider resistance, across which the calibration voltage is read, should be used which has a resistance of not more than 10% of the input impedance.

The amplifiers of Figs. 3, 4, and 5 have a flat response from dc up to the cutoff frequencies cited and so dc calibration suffices for ac measurements also. This will generally be the case where the rolloff capacitors used are those specified by the manufacturer. If data for the capacitors is not available, it may be necessary to calibrate the amplifier for accurate ac measurements by using an audio or rf generator having a calibrated output.

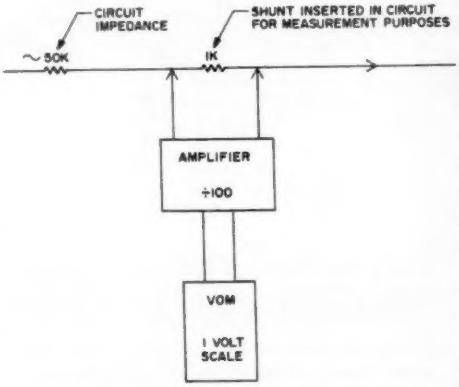


Fig. 6. Another use for the amplifier is to allow very low current measurements in high impedance circuits with simple instruments. In this case 1V scale on VOM is converted to a 10 μA range.

Other Uses

The amplifier unit can be used for a variety of purposes besides that of increasing the sensitivity of an instrument for ac and dc voltage measurements. A simple extension of its use is for the measurement of extremely small currents in high-impedance circuits. For instance, a VOM may not be able to measure directly a current in the low microampere range. By inserting a shunt resistance in the circuit and measuring the voltage across it with the aid of the amplifier, as shown in Fig. 6, one can turn the 1V scale on the VOM into a 10 μA scale. The amplifier can be used as an aid with an rf probe to increase the sensitivity of measurement. Also, because of its frequency range, it can be used as a general-purpose audio preamplifer, i-f amplifer, etc., for a variety of test and experimental purposes.

. . .W2EEY

Ladimer S. Nagurney WA3EEC/1
Department of Physics
Brown University
Providence RI 02912

A POWER SUPPLY FOR SMALL FM RIGS

Spend some time home with the family

The chief disadvantage of many small FM rigs is the lack of a built-in ac power supply. The current drain of most low power rigs is fairly low so a simple power supply can be built quite cheaply out of standard parts. This power supply can be used as a base on which to rest the rig while operating using ac power. While this supply cannot power amplifiers, in most areas no amplifiers are needed to work many stations. The batteries can be charged while using this supply so the rig will always be ready for portable use.

Circuit

The circuit used is a bridge rectifier and a series regulator using a 2N3055 transistor. The flag type 2N3055 will dissipate 3½W without a heatsink, while the TO-3 type will dissipate 5W without a heatsink. By keeping the dissipation below these levels heat sinking is not needed. The method used in this supply is to put the resistor R1 in series with the collector of the transistor. Thus the resistor and not the transistor dissipates the power. With an 8Ω resistor the transistor dissipation is about .3W on receive and 1.25W on transmit, permitting cool operation.

The 1000 μF capacitor in conjunction with a transistor beta of about 50 makes an effective filtering of about 50,000 μF. The result is negligible ripple in the millivolt range when the supply is operated at full output.

Construction

The supply is mounted on a piece of perf board in a gray hammertone minibox. The toggle switches and neon pilot lamps are located on one end with the output cable, line cord, and the fuse on the other end. The board is mounted upside down in the box using brass screws and hex nuts.

All parts including the transformer are mounted upon the circuit board. A negative bus of 14-gage wire runs along one side almost the whole length of the board. The layout is similar to the schematic.

The dropping resistor R1 is made from 4-32Ω ½W resistors, although a 6.8 or 8.2Ω

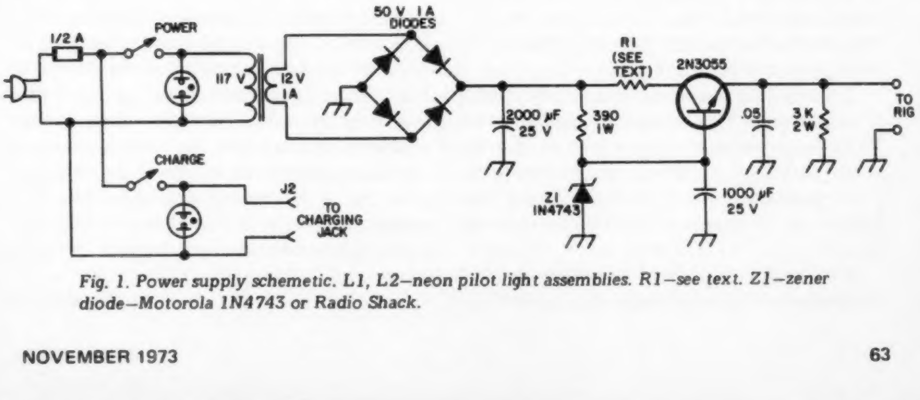
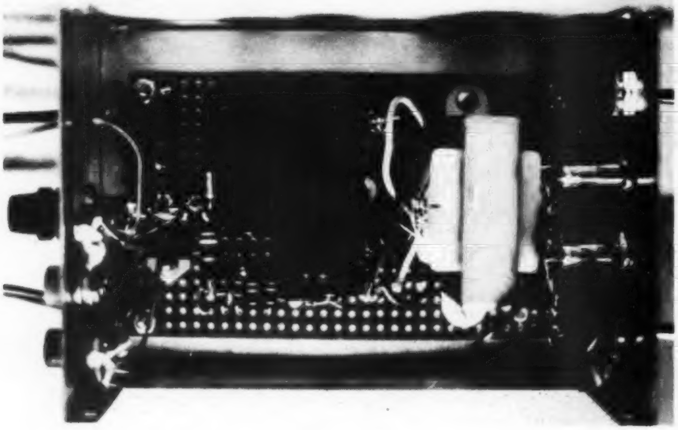


Fig. 1. Power supply schemetic. L1, L2–neon pilot light assemblies. R1–see text. Z1–zener diode–Motorola 1N4743 or Radio Shack.



A view inside the power supply cabinet showing the circuit board.

5W resistor may be used if on hand. For rigs other than the TR22 (the rig with which I was working) the value for R1 may be calculated from the equation

$$R = \frac{Vs - Vout - .7V}{Ixmit}$$

where
Vs = Voltage at capacitor
Vout = Output voltage
Ixmt = Transmit current

For my supply there was 17V in and 12 out so 17-(12+.7)=4.3V. The transmit current is ½A thus an 8Ω resistor can be used. Resistor dissipation is 2W while transistor dissipation on transmit is .5W. The actual resistor value should be slightly less than the one calculated. Note that whatever the case the transistor is operated well within its ratings.

The banana jacks on the rear of the supply are used for testing other circuits with the power supply. A short cable is used to provide power for the TR22.

The cable to the charge jack on the TR22 is made from a TV cheater cord. Because the TR22 has an internal charger with-in, it only needs 110V ac to charge the batteries. If your rig does not have a built-in charger, the cabinet of the supply is large enough to add one.

The only precaution necessary before working on the power supply is to make sure the capacitors are shorted out. Although there is a bleeder, with such high capacitance values the time constant becomes large. Some have said 12V cannot kill. While this may be true I still like to take some safety precautions.

Although a Radio Shack zener was used, a Motorola 1N4743 will provide about 12.3V out instead of the 11.5 I get with the one in the supply. I have noticed no degradation of signal strength or loss of transmitter power due to the low input voltage.

To test the supply do not connect the rig to the output. A friend did this and a shorted transistor drastically shortened the life expectancy of his rig. A 240Ω 2W resistor can simulate the TR22 on receive, while a 24Ω 10W resistor can serve on transmit. It's better to be safe than sorry.

Conclusion

This supply was built in December 1972. It is used to monitor 94 simplex 24 hours a day, seven days a week, in my home in Providence. Even after operating for weeks at a time there has been no failure and no problems of any type. No hum is detected on the audio and the ripple is less than the noise on a laboratory quality meter. The supply can be built for about $15.00 and makes a fine addition to any shack. See you on the air.

. . .WA3EEC/1

A RADIATING LOADING COIL

John Risch W0FEV
3508 Whispering Woods Drive
Florissant MO 63031

For SWR adjustments in the shack.

How would you like to have an effective 80 meter antenna? If you would, but haven't the sufficient space to put up a "textbook" antenna, you should try this one. The overall length is about 230 cm and it can be located inside your shack or outdoors. It is effective. I've worked many VE3's from St. Louis, Missouri on 80 meters CW with reported signal strengths of 7 and 8 using only 80 watts input to a Heathkit DX605. The cost is less than $5 and it can be constructed in one or two evenings. The swr is less than 1.2 to 1 as indicated by a Heathkit swr indicator HM-15 over the whole portion of the 80 meter CW band (by adjusting taps).

After unsuccessfully trying to load up a random wire antenna on 80 with a low swr and no rf in the shack, I decided I needed seomething else. A review of available antenna manuals, handbooks, etc., convinced me there was no way except to use a half wave wire or a dipole with quarter wave tuned feeders. I simply do not have that much free space at my QTH, not unless I erected a tower in my front and back yard.

I was about to give up ever working 80 meters until I got interested in shortened antennas. Most of these, however, required center (critically adjusted) loading coils or complicated matching devices.

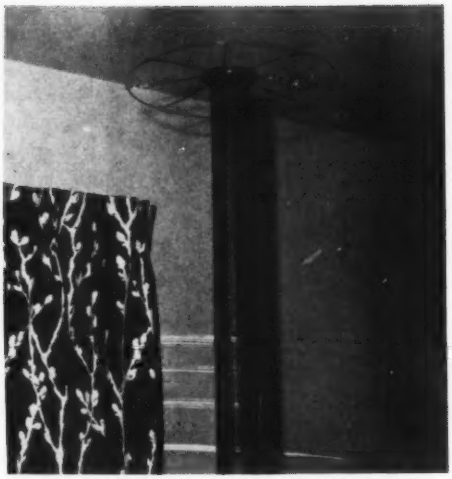
One that appealed to me was the Helix, briefly described in the ARRL Handbook. It is nothing more than one half wavelength of wire, helical wound on a long coil form and operated as a quarter wave vertical against ground and fed with 52Ω coax.

The Handbook showed how an adjustable loading coil could be used to change frequency. My thoughts were, why not consider the whole helix as one continuous linear loading coil, provide taps on it and feed it directly without any external coils, tuners, etc. That's what I did, and it worked.

Once you select the band you want to build for (you should be able to build a Helix for any band) you should consider where it will be located – indoors or out. If indoors, naturally it won't have to be quite as rugged and should be small enough to move conveniently. You could use almost any material for the form – plastic, paper tubes, wood dowels, etc., as long as it suits your needs and is considered low-loss at the rf frequencies you will be using.

I used cardboard (paper) mailing tubes as they were readily available at the local stationery store. Most tubes of this type have telescoping lids. Both the tube and the slip-off lid had formed-in metal end caps. Try to use this type of tube if possible, as they are easier to work with. The diameter can be anywhere from about 4–7.5 cm and the selection should be based on the band the antenna you are making will cover. Naturally, forms for 75 or 80 meters should be of a larger diameter than a 40 meter one to avoid crowding the turns. Obtain as many tubes as needed to make up the length of form you want. If you use those with metal ends, remove them with a small saw. Either use the "necked down" end of one tube to slip into the other tube or use a separate piece of smaller diameter tube to fasten them together. Use Duco cement, Elmer's Glue or any other good cement to join the tubes. Do a good job as it's difficult to reglue them after they are wound.

Whatever type of form or forms you used, you should end up with one long form 200–250 cm long and about 7.5 cm diame-



This particular model almost reaches the ceiling of the shack. A wire capacity hat was added to increase the effective height and bring more rf current up the coil.

ter (for 80 meters) with a metal end at each end only. If open-end tubes are used you will have to add some sort of mounting brackets. The completed tube should be thoroughly saturated with Spar Varnish or a good grade of shellac, inside and out. I poured varnish inside and rolled the tube around while tilting it back and forth before I glued it together. I would advise against using paint as there may be some metallic pigment in it which would affect the Q.

Prior to actual winding, determine the pitch (number of turns per inch) to use in order to uniformly wind the coil to fill the entire length of the tube. Leave a few cm at the bottom for possible additional turns – discussed later. This is easy for those who are excellent at math, but the rest of us will have to use the formula $C = \pi d$, where circumference equals pi (use 3.14) times the diameter of the form. You can calculate the length of wire to use, or look it up in the Handbook. You will need to wind one-half wavelength of wire on the form. Since you know the length of the winding space on your form, this formula will tell you how much wire (in length) will be needed for one turn. Divide this number into the total length of wire (40.84 meters for the 80m band) to see how many turns your coil should have.

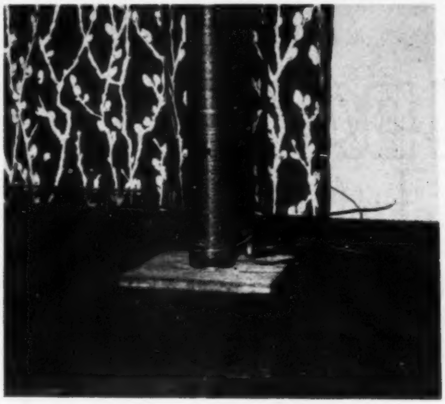
For my 7.5 cm diameter form it came to 174 turns. Since it was 225 cm long, it required 1 turn each 1.3 cm. Use a metric rule and mark the form at 1.3 cm intervals. When you wind be sure that the wire crosses each successive mark. It's all right if the pitch varies a little; it does not have to be perfect. The best way to wind is to have another person slowly rotate the form for you. I used No. 16 AWG solid enamel wire, but any suitable size could be used. It would depend on the power you intend to use and the total number of turns. I suggest that you not use anything smaller than 16 AWG.

When you have wound on about 90% of the wire or about 160 turns, you should tap every second turn from then on. These taps will be at the bottom of the antenna and will allow you to cover the entire band. Wind a few extra turns (about 5 or so, at least) to compensate for any miscalculations. To make the taps, scrape a few cm of the enamel insulation from the wire, (bare wire could be used if available) and twist a loop in it and solder before continuing to wind. After you have completed the winding, it can be terminated by drilling two holes through the form and threading the wire through each.

The completed coil should be given several coats of varnish or other low loss material to hold the turns in place. If you are going to use it outdoors, then additional weather proofing measures are necessary (coat with clear epoxy, etc.).

Mount on a suitable wood or plastic base. A 20 x 20 cm piece of plywood is satisfactory. Either run screws up from the bottom into nuts soldered to the bottom metal end cap or use several small "L" brackets. Mount a female coax connector to this base also with "L" brackets. Solder the free end of the coil to the center conductor of the coax connector along with a short length of flexible wire equipped with an alligator clip for reaching the taps. Mount a binding post on the mounting base and connect it to the coax shield for grounding.

A capactive hat can be a metal disk about 30 cm in diameter or wire radials (No. 10–12 AWG solid wire) about 30 cm long.



The base is a piece of plywood with a coax connector attached for easy disassembly.

Solder the disk to the metal end cap or mount with small "L" brackets and connect to the top of the coil. If you use wire, simply poke them through one side of the form out the other side. Use about 6 or 8 pieces and solder them where they cross at the center. Then form a circle of stiff solid wire around the ends of them and solder to form a complete loop or halo with spikes.

Tune-up is straightforward. Try loading it up with reduced power first at the low end of the band. Use some sort of reflected power or swr indicator and check the loading. Soon you will find which tap to use for the low end of the band; then move up and repeat the procedure. If suitable loading at full power for your rig and low swr cannot be obtained, you may have to add more turns or unwind some from the bottom and add more taps.

As this antenna is used as a quarter wave vertical, it must be operated against ground. I used a single 200 cm ground rod driven in the ground outside the window of my shack and used a length of copper braid to the ground terminal on the antenna.

I imagine that an antenna of this type would work very well outside with a set of full size radials. I also imagine that a 20 or 40 meter antenna would work equally well. Using similar construction techniques a multiboard antenna form could be assembled in a few hours.

. . .W0FEV

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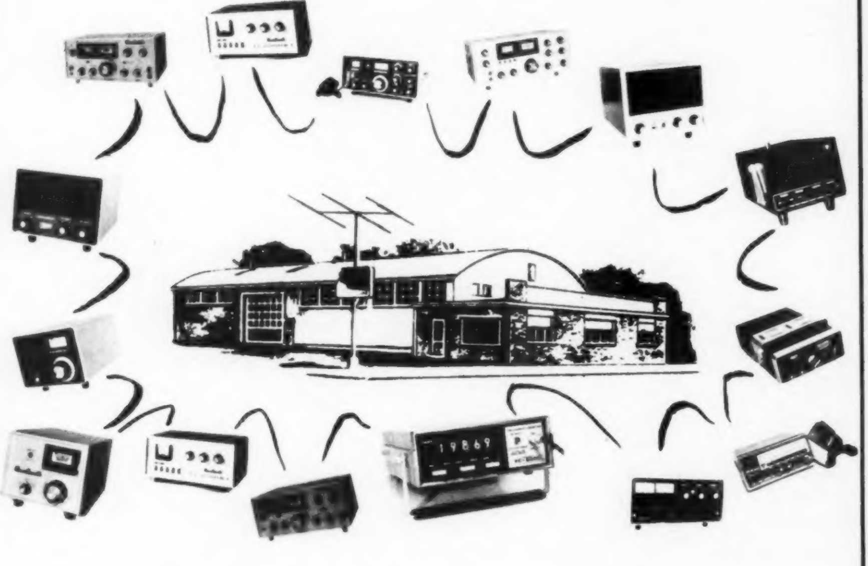

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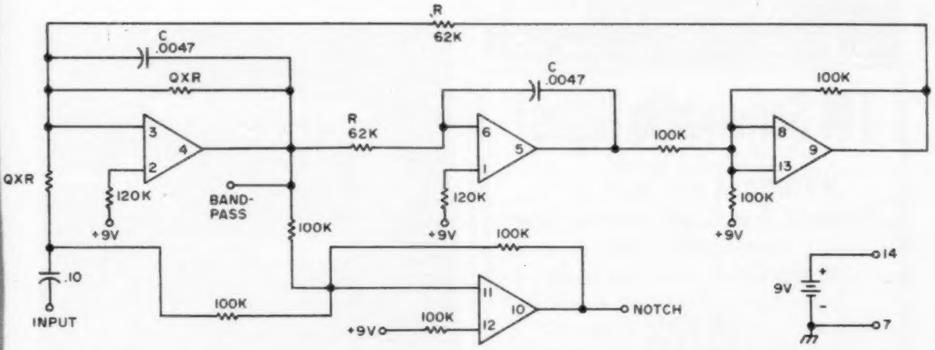
PEAK / NOTCH IC AUDIO FILTER

Operational amplifiers such as the 709 and 741 have made it possible for the amateur builder to construct CW audio filters that have excellent characteristics. However, typically, these operational amplifiers require a dual power supply, i.e., ±9V. most amateur equipment is designed to operate from a single power supply, +12 for example. Motorola has recently offered a "monolithic quad single supply operational amplifier," the MC3401P. Detailed specifications are described in their Bulletin No. DS 9191. It is essentially 4 internally compensated operational amplifiers in a single 14 pin TO-116 package. The power supply is + only; +5 to +25V.

Motorola's Bulletin describes several possible uses for this chip. The unit that I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C
.0047
QXR
3
4
2
120K
+9V
BAND-PASS
100K
QXR
.10
INPUT
100K
R
62K
C
.0047
6
5
1
120K
+9V
100K
100K
11
10
12
+9V
100K
NOTCH
100K
100K
8
9
13
100K
+9V
9V
+
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14
7

Fig. 1. Schematic of the peak/notch audio filter using the MC3401P.

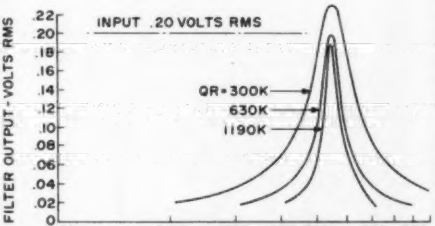

Fig. 2. Measured characteristics of the bandpass filter using different values at QxR.

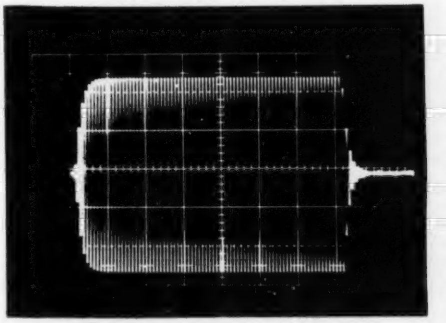

Fig. 3. Keyed waveform, QxR = 300K. Horiz. = 20 msec/cm.

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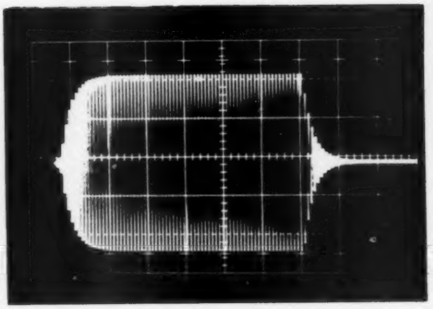


Fig. 4. Keyed waveform, QxR = 630K. Horiz. = 20 msec/cm.

constructed is a peak and/or notched CW audio filter. The single supply makes it particularly attractive to amateurs with receivers using only one supply.

Fig. 1, shows the schematic diagram of the filter. The center frequency of the bandpass or band reject is determined by R and C.

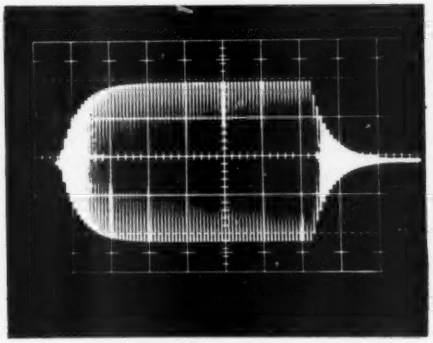


Fig. 5. Keyed waveform, QxR = 1190K. Horiz. = 20 msec/cm.

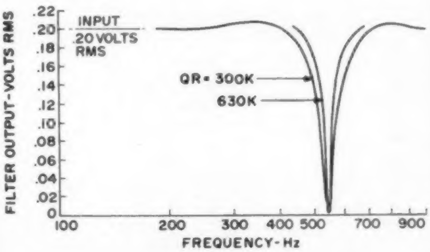


Fig. 6. Measured characteristics of the notch filter using different values at QxR.

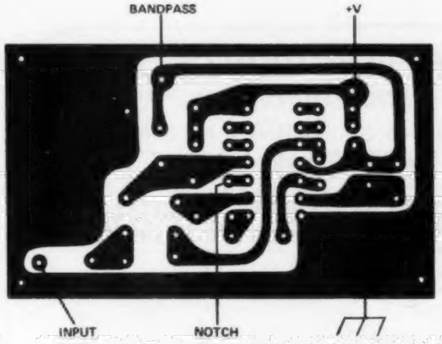


Fig. 7. Full size pc board layout (foil side) for the peak/notch filter.

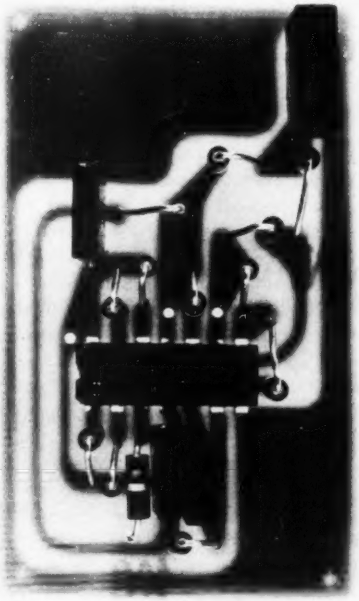
For the unit shown R = 62K and C = .0047 μF which yields a center frequency of 540 Hz. The actual unit peaked/notched at 545 Hz. The measured performance of the peaking filter is shown in Fig. 2. The variations in bandwidth are achieved by varying the two resistors marked QxR. If these two resistors were grouped together, one could achieve variable bandwidth with only one central knob. The gain of the circuit is nearly unity but it can be varied as described in the Motorola Bulletin.

The 6 db bandwidth of the sharpest filter tested was 66 Hz. Figures 3, 4 and 5 show the keyed waveform of the three bandwidths shown in Fig. 2. The keyed waveform is clean and sharp with rise and fall times determined by the filter bandwidth.

The notch characterisitcs of this filter are shown in Fig. 6. The gain of the filter outside the notch area is close to unity. A single pole double throw switch can be used to switch from bandpass to band reject, depending on the nature of the received signal. For example, bandpass would be best for CW while band reject could eliminate an undesired CW signal near a single side band signal without destroying the information content of the SSB signal.

Fig. 7, gives a full size template, foil side, for a printed circuit board. The price of the MC3401P operational amplifier is near a dollar, truly a bargain for such impressive performance.

...W6AGX



The input capacitor is at the top right in this photo.

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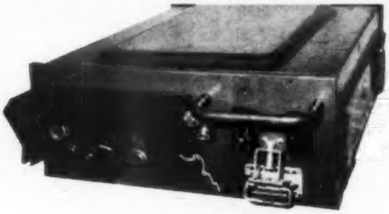

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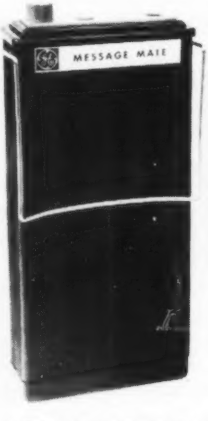

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POWER FAILURE PROTECTION

Protect your QTH from the Energy Crisis!

Power interruptions in heavily-loaded and densely-populated areas are seldom simple on-off phenomena. In many residential areas if the power goes off for more than a few seconds it may take hours to restore complete service, even though the initial cause of the outage is corrected promptly. Because of the dependency of our modern culture on electrical power, extended outages can paralyze large areas, stopping everything from traffic lights to electric can-openers.

This extension of simple outages is brought about by the non-linearity of many electrical devices. Their starting current is many times greater than their running current. Many motors, for example, have starting currents from three to ten times their full-load running current. Lamps, similarly, and nonlinear having a cold resistance of from one fifth to one tenth their hot resistance.

In consequence of these characteristically heavy starting currents, if the power fails in a heavily-loaded area perhaps due to systemic overload, restoration of the power is likely to impose an immediate load several times greater than it was at the moment of interruption. This is likely to precipitate another outage beginning a vicious cycle which can only be broken by sectionalizing the loads at the power house or at some convenient substation. Such repeated outages have occurred several times during the past few years in a number of our larger cities.

Remedial measures

When the power fails for any reason a recurrence of the failure on restoration of the power can be prevented if all power users turn off all heavy loads immediately. When the power has been restored the heavy loads can be turned on again, one by one, without imposing too great a starting load on the system. This simple instruction is much easier to give than to follow.

Automatic shutoffs

Because most power outages occur at odd times when "the man who knows what to do" is at work, out for a beer, or otherwise unavailable, some sort of automatic shutoff

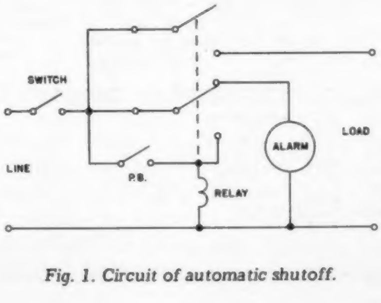

Fig. 1. Circuit of automatic shutoff.

for heavy loads such as deep-freeze, air conditioners, electric ovens, etc., is desirable. Most fortunately, such devices are relatively simple and not too costly, even for loads of up to 25 amperes (or more).

Circuit of one smoothly-working automatic shutoff which effectively disconnects the load from the line whenever the power fails, and which does not reconnect it when the power is restored, is shown in Fig. 1. This is one form of the self-holding relay circuit.

In operation with the power on the load is not connected until the switch is closed, and the push button momentarily depressed. This energizes the relay, connecting the load through the upper armature contact, and connecting the coil to the high side of the line through the lower armature contact. Opening the switch turns the load off.

If the power fails the relay armature releases, disconnecting both the load and the relay coil from the line, and putting the alarm in circuit. This can be anything from a neon lamp to a raucous ac buzzer. When the power is restored the alarm is energized, but the load is not. Depressing the push button momentarily reconnects the load to the line and deactivates the alarm so that the load operates normally until either it is shut off or the power fails again.

Higher power shutoff

Many relatively large lelectrical loads such as building air-conditioners, cannot be started merely by connecting them across the line, but must be run up to speed by use of a control box or Variac. If the power is interrupted while they are running, and then restored, they tend to either pop the breakers, or to run at half speed and high heat eventually damaging the motors. They must be started each time from Variac zero.

Although some of the more modern air-conditioners have an automatic starter which gradually speeds up the motors when the power is applied keeping the current drain from the line within safe limits at all times, many systems now in use do not have this convenience and need protection in event of power failure. Circuit of an automatic disconnect so that the Variac must be returned to zero before the system can be started or restarted, is shown in Fig. 2.

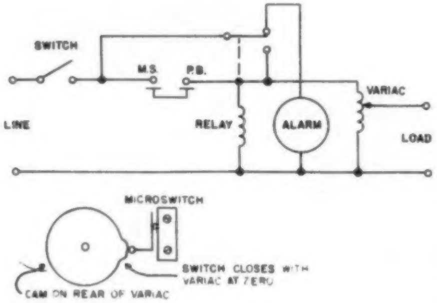

Fig. 2. Automatic disconnect for Variac starters.

Here we again use a self-holding relay in conjunction with a push button and a Microswitch controlled by a cam on the Variac shaft. When the Variac is set at zero, and only then, the pushbutton is connected to the line so that it can close the relay circuit. Once this is closed it is self-holding and the Variac is energized so that the motor can be run up to speed by the Variac control.

If the power fails, the relay releases, disconnecting itself, the Variac, and any load controlled by it from the line; and connecting the alarm. When the power is restored the alarm is energized, but the load cannot be reenergized until the Variac is set to zero which closes the Microswitch so that the push button is operative. The alarm automatically reminds the operator to either turn off the switch or to complete the starting cycle.

Construction and workmanship

Both of the devices here outlined are of a safety, or "insurance", nature. In consequence, they should be built with considerable care using components chosen with an adequate margin of safety. Layout should be chosen for maximum convenience of operation and construction be such that checking and maintenance are easy. Local electrical codes should be followed as closely as possible. If the local code does not cover, "due diligence" will be demonstrated if you follow the National Electrical Code.

. . . Ronald Ives

Donald C. Mead W2LT
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160m ANTENNA COUPLER

Work DX on 160m with a 2 meter beam

One-Sixty! Aw, come on, man, that's dc. No, I've never tried it. After all, who has a back yard big enough for a dipole that big!"

Doubters, rejoice and take heart. It is possible to give off good vibrations from a teeny wire on top band, if you know how. First, you must overcome the wavelength gap. That is, think positively and accept the fact that an antenna doesn't have to be self-resonant. Seems like we've been brainwashed to the point where antenna means a half wave center-fed dipole. Look at it this way: an antenna wire can be simply one plate in the capacitor of a parallel-tuned circuit. The other plate, as you can probably guess, is earth ground. Add a coil to resonate with the capacitance and you have a radiating system. Figure 1 shows the derivation, step-by-step.

As every Novice knows, the circulating current in a parralel-resonant circuit is maximum at resonance. He also knows that the more rf current in a conductor, the stronger the field around it. Thus, if you build a giant parallel-resonant circuit, say 30m or more in diameter, and pump rf through it, some of the rf will leak off and cause a desirable disturbance in a receiver a surprising distance away. If you tune the circuit to the same frequency as the pump (the transmitter) current and field strength are greatest.

As mentioned earlier, one capacitor plate is earth ground. The other plate is any metallic object spaced and insulated from ground. It can be a coax-fed doublet, a two-meter beam or just about any imaginable aerial adornment you're using on the other bands . . . just be sure it isn't grounded outside the shack somewhere. If you have more than one antenna, you can connect the feed lines together. The more the merrier and the more capacitance to ground. In the case of coax-fed antennas, connect the shield to the center conductor and treat it as one wire.

In order to get rf into our newly discovered antenna circuit, we must solve the problem of matching a low impedance transmitter to a high impedance antenna. This turns out to be no problem at all if we take advantage of the fact that the inductance of the antenna circuit is available in the shack. Although we could wind a low impedance link on the antenna coil, it turns out to be far easier to let the transmitter share part of the antenna inductance, using the principle of the autotransformer. That is, in the same way you can tap off a small voltage from a large voltage, using a resistive voltage divider, you can tap off a small impedance from a large impedance using an inductive impedance divider.

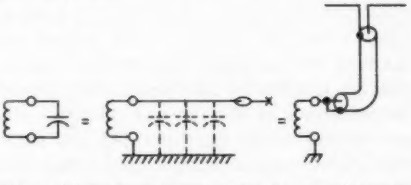

Fig. 1. An antenna is equivalent to a tuned circuit.

Enough theory! Let's get down to the nitty-gritty of practical circuits. And how simple it is! All that's required is one coil, two alligator clips and an rf current indicating device. The latter may be an rf ammeter, say 0–30A or so, or can be a couple

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of pilot lamps wired in parallel to share the current.

Figure 2 shows the lash-up. For operation on the 1.8–2.0 MHz band, the winding should be at least 5cm in diameter, about 13 cm long (the bigger the coil, the better) and have about 40 or 50 turns of bare or tinned copper wire. About any old coil will do. If you can't find one in surplus, wind it yourself.

Setting the taps on the coil is largely a matter of cut-and-try. The thing to keep in mind is that the position of the bottom tap controls the coupling between the antenna and the transmitter; the upper tap controls the resonance of the antenna. Although you can do the whole thing by trial and error, having a vswr meter in the coax line between the transmitter and the coil makes life simpler. If you have a grid-dip meter as well, it's a real breeze.

With test equipment, proceed as follows:

1. Connect the bottom of the coil to ground. This can be the plumbing in your house, a ground rod or whatever you use for a normal ground connection.
2. Connect a jumper from the outside plug shell of the coax line of your antenna to the center pin of the plug. Connect the shell to an alligator clip connected to the 30th turn from the bottom of the coil.
3. Couple a grid-dipper, tuned to 1.8 MHz, to the coil. Adjust the top tap by selecting a greater or lesser number of turns with the alligator clip until resonance is achieved.
4. Connect the coax outside braid on the line from your transmitter to the bottom of the coil (ground). Connect the center conductor to the 10th turn of the coil, using an alligator clip.
5. Turn on the transmitter (tuned to a vacant frequency) and adjust the bottom tap and the transmitter loading control for minimum reflected power. Be sure you don't exceed the maximum transmitter power input for your geographical area.
6. Readjust both taps until you have maximum antenna current and minimum reflected power.

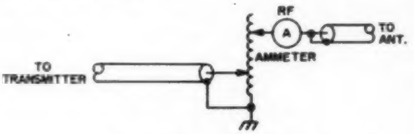

Fig. 2. The tuning system.

With no test equipment, simply adjust both taps and the transmitter loading control until you get maximum antenna current for any particular value of plate current.

High rf voltages are present in the circuit under key-down conditions, even with moderate transmitting power. Therefore, play it safe and do all your adjusting with the key up.

If you are a newcomer to 160, be sure to check the regulations on sub-band frequencies available and the maximum daytime and nighttime input power restrictions that apply to your state.

So, come on in and join the fun. 160 is open to both phone (mostly SSB) and CW. Even the most jaded DX-chaser will get a real kick out of working across the Atlantic when the signals start pouring in on those cold winter nights.

. . .W2LT

Richard W. McKay K6VGP
29315 Stonecrest Road
Rolling Hills Estates CA 90274

THE HT120: ONE UP ON MOTOROLA

1
2
3
4
5
6
7
8
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0
#
MOTOROLA
HT 100

The relationship of the hand units with the silver dollar at the right is one of size comparison only.

Owning the very latest in Handi Talkies had always been the apex of many FMer's ambitions. I myself have looked on, green with envy, as one of my buddies showed me his new six channel five watt HT220; but the price stopped me dead. Well, if you aren't rich, but are the type who likes to be the first on your block with a new goodie, try this on for size: An HT with one watt output (minimum), receiver rated at .3.35μV for 20 db quieting, Private Line, six channels, and even Touchtone, all in a box the size of an overgrown package of cigarettes and costing less than $200! I should have you hooked, so read on.

Recently HT220s seem to be showing up everywhere.

It should be noted that the circuit boards that form the heart of these units are not always perfect, but whatever the problem they can usually be fixed. As an example, the circuit boards are constructed without trimming each component lead individually as it is installed. At the end of the production line a saw is used to trim all the leads simultaneously. Occassionally the saw takes a nip out of the board itself, forcing quality control to reject it. On others, a small wire jumper or component may have been installed on the rear of the board to circumvent a board problem; and although the board may have been removed from a working and tested unit, Motorola, tightening their quality control, will no longer allow these jumpers in units offered for sale.

In these cases the unit is disassembled and Spectronics acquires the completed circuit boards for resale to amateurs. With a complete HT220 board, new case, parts, controls, hardware and the manual, you can come pretty close to rolling your own.

The basic HT220 is a compact single frequency version, rated at 1.8 watts output. Slightly larger housings make available such options as a 5 watt output deck (capable of up to 10 watts), Private Line, two, four or six frequency capability, and even Touchtone; or varying combinations of all of these.

By the time I was aware of all of this, I had already completely remade my HT220, and since the HT220 with all the additions of my HT200 would be close to the same size, I decided to hang on to my HT200 until I could acquire a radio that would represent a significant reduction in size.

Thus, I was quite happy until one night at SAROC in Las Vegas. While I was wandering around, I managed to stumble into a Motorola HT100. That's the little critter about half the size of the HT220, but rated at only 100 milliwatts output. I had once

The upper left corner of this picture shows the stock Motorola PL deck, which slips into the niche in the back of the unit. In the lower right corner is the PL reed plug.

considered the HT100, but thought the power output too low for reliable coverage. As the little gadget was discussed it was plugged into a wattmeter and checked out at 1.8 watts!

Well that took a little explaining. It seems that the HT220 and the HT100 share the same circuit board. The only real difference is that in the HT100 the final output transistor is eliminated and the driver is matched to the antenna for 100 milliwatts output. In addition, a higher impedance speaker is installed to lower the battery drain and a much smaller battery is installed, form fitting the case at the rear of the circuit board rather than below it. In this case the HT220 board had been installed in the HT100 housing and presto, the birth of the HT120 (HT120 is my own personal designation for the unit.), a 1.8 watt HT100.

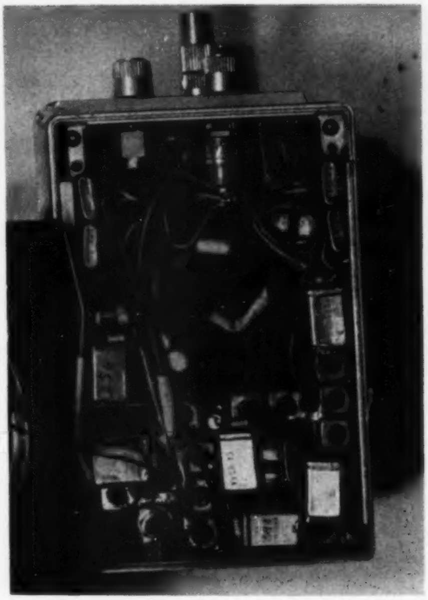
There is of course an obvious fly in the ointment. Motorola portables are designed with an eight hour 5-5-90 duty cycle (5% transmit, 5% receive, and 90% standby). This is Motorola's criteria for choosing the battery size for a particular model. In the case of the standard sized HT220 this requires a 225 mA battery. So considering the HT100 uses a 70 mA battery, the apparent normal duty cycle of the HT120 would be 2½ hours at 1.8 watts. In practice, however, I have found that I have been able to use the unit for more than a full day by carefully choosing my words, not being long winded, and by detuning the radio to one watt output, thus further reducing the battery drain. More about that later.

Well, I had to have one. Of course I needed built in PL and multi-channel capability, but I was sure that I could do that, so I ordered all the parts. I then acquired the manuals for both the HT100 (Motorola part #68P81065A25-A, and the HT200 (Motorola part #68P81059A20-B).

A note on crystal ordering. Don't be too concerned with an improper receiver i-f crystal for the 146-148 MHz range. Different i-f crystals are specified to prevent a harmonic from interfering with the intended receive channel. Although my unit does have the wrong crystal for the 146-148 MHz range (16.8 MHz), I have encountered next to no difficulty. I am currently receiving on 146.61, 146.64, 146.82, 146.94, 147.33 and 147.36. Of all of these frequencies the only one I have encountered any problem with was 147.33, on which I found a slight harmonic carrier a bit off channel; but it was so low in level that it was just barely detectible.

After installing the crystals that I could in their stock locations, I used the exploded view of the unit in the HT100 manual to assemble it. Then referring between the HT100 and the HT220 manuals I connected the various color coded leads to the frequency control switch, volume control, PTT switch and the battery case. I found a parcel of wires that had been connected to the PL board in the HT220 installation; I cut these off as close to the board as possible.

Next it was necessary to remove the spring contactor that joins the coax output to the antenna on the matching case half,



If you take care, all those crystals can be sandwiched into the unit.

since they are in different spots in the HT220 and the HT100. There was one hole in the board in the correct place, and I drilled another to mate with the bottom half of the spring contactor. I then rerouted the coax and connected it to the spring contact, with the shield to ground (the metal case near the frequency switch). Next I connected R40 (the internal squelch control) to it's corresponding wires. After checking the "A" line with a VOM to ground to insure a reasonable chance of having no problems, I connected 14V dc and turned it on for the smoke test. The first good sign was squelch noise.

It took very little tuning to get the receiver to better than it's rated .35mV for 20 db quieting. The transmitter was just as easy. Considering the transmit time necessary for tuning, doing so on the battery could prove harmful. I would recommend a regulated current limited bench supply capable of 14V at 500 mA, such as the Heath IP 27.

The tuneup procedure was very straight forward, and I did not find it necessary to add any padding capacitors to the unit. If you cannot tune to the factory specifications, refer to the manual for the value differences between the "H" capacitors (150.8-174 MHz) and the "L" capacitors (136-150.8 MHz) and add about 60% of the difference to the bottom of the board in the troublesome circuit and retune. I recommend 60% of the difference to optimize tuning in the 145-147 MHz range.

The largest caution in the tuning procedure is the current drain on transmit. I initially tuned my unit up on a bench supply without monitoring current drain. I was able to obtain three watts output, but found later that I was drawing in excess of 500 mA. Here again monitoring the tuneup on a current regulated supply will prevent many problems and save a lot of time. I found that even tuned to the rated 1.8 watts the current could range from 310 mA to about 500 mA.

I then correctly tuned the radio to 1.8 watts and 310 mA current drain, and connected it to the ni-cad battery. The battery proved capable of supplying the load, but it was obvious from the voltage drop that the battery couldn't handle this type of use over the long run. If you find 1.8-2.0 watts essential, the HT120 will reluctantly provide it for short transmit periods. I chose, however, to reduce the output to one watt, and through careful tuning and retuning of L107, 109, 111 and 112, I was able to minimize the current drain to 230mA. This will greatly increase the length of talk time avatlable, and the time between replacement of the battery. Best of all it means that the output of my HT120 is less than 3 db worse than the standard HT220, and yet, 10 db better than the HT100, in the same size package – to me a reasonable compromize.

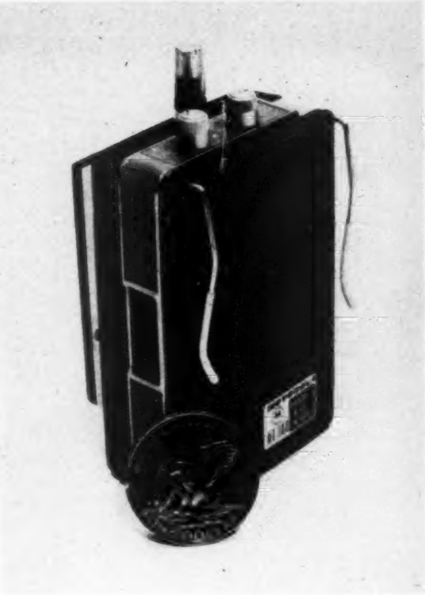
Next I decided to tackle the multichannel problem. I wanted to try for six channels. The HT220 board makes the job an easy one, since all that is required to add channels is a crystal, a resistor, and a coil. I obtained the six channel switch, and installed it in the "squelch on/off/F1-F2 switch" position. Since my unit was a stock two frequency unit, I wired the first two switch positions to the circuitry already on the board. For the other crystal positions refer to the picture.

I first attached the load resistor directly to the leads of the crystal. I then soldered the crystal to a convenient transformer can to achieve both a mechanical mounting and an electrical ground. You will find many small spaces between the components on the board and the case where chrystals can be placed on their sides and not interfere with assembly of the unit. I must caution you though, to use the most delicate soldering technique you can master. It is extremely easy to break the crystal within the case with even moderate heat. Next, I bent one lead of the crystal around and soldered it directly to it's case. I then attached a teflon wire to the remaining crystal lead and routed it to the coil; the other lead of the coil being connected to the frequency switch. I placed two coils horizontally, one adjacent to the two stock receive crystals and the other cez to the bottom of the unit. The remainder of the coils were placed in whatever holes I could find; primarily near the volume and frequency switch controls.

At this point you might wonder why I mounted the crystals and coils in the manner described and neglected that "chasm" between the frequency switch and the case. Looking again at the pictures you will find that this is where the subminiature reed for the Private Line oscillator mounts. If Private Line is not a necessity on your radio, I would indeed suggest this as an excellent place to mount both crystals and coils. Perhaps I should mention here that crystal lead length appears to be no problem. Several of my crystals are as far as they can get from the oscillator, and I have found no problem with them oscillating or getting them on channel.

To make the job more professional, I removed the stock two frequency escutcheon and took it to my jeweler. He was able to turn the plate over, elongate the holes to accomodate the volume and frequency switch shafts (the holes are slightly off center), and re-engrave it with vol/off, F1 through F6, and my call. Although this cost $7, I thought it worthwhile in ease of use and eye appeal.

As I mentioned earlier I needed PL in my unit. I decided to order the stock unit from Motorola. The PL deck (Motorola part NLN 6801A) and the reed (Motorola part TLN 8904A) cost $50, but I wanted the unit as professional as possible. Since I could never locate a picture of the HT100 with the PL deck installed several calls to Motorola gave me enough hints to get the job done.



A belt clip fashioned from modified hair curler springs. The springs are epoxied into small holes drilled into the panel.

The PL deck itself fits in one of the two niches in the section of the case that houses the antenna. The main body of the reed fits in that "chasm" I was talking about earlier, next to the frequency switch. The pins project through the circuit board, two of the pins going through holes you must drill. The reed plug mates to the pins of the reed from the non-component side of the board next to the frequency switch. The deck is then wired as per the instructions in the HT100 manual. A very simple connection to the transmit switched 14 VDC, ground and audio out.

This is perhaps the most unusual PL deck and reed that I have encountered. In many PL circuits the reed is under continuous oscillation since it usually takes about one to

A size comparison of the HT100 with the HT200 – big difference!

two seconds for the reed to "come up to speed." This circuit and reed, however, receive no power until you begin transmitting, yet the PL tone is immediately at the full deviation level needed. On a modulation scope I could see no signs of any start up time, the full sine wave was immediately apparent. One other difference from most PL boards is that receive PL is not available. Due to space limitations the PL board provides a tone for transmit only, the receiver is not tone coded. This should be no handicap for repeater use, however.

A final addition to the unit is Touchtone. A year or so ago I developed a technique of adapting a Trim-line Touchtone pad to my HT200 using internal power. I later adapted the same Touchtone pad to my HT120 as a temporary Touchtone device. At the time I realized that I would eventually be using a much smaller device, but I did need tone control immediately. In mating the Touchtone pad with the HT I wanted a semi-permanent mounting that would allow the HT to be held in one hand with the push to talk activated, while the other hand was free to use the buttons on the pad. To accomplish this I mounted the pad in a small LMB box, making both the mechanical and electrical connection to the HT through a subminiature phonejack and plug. The bottom of the pad is stabilized on the HT with small strips of "Velcro." Luckily this technique for Touchtone was temporary, since the pad and box was nearly as big as the talkie itself.

I acquired a very small and reliable Touchtone device manufactured by Waller Electronics in Chevy Chase MD. John Waller currently has in production a device he calls the "Tesco pad." It is available in kit form, wired or as a "sealed Tesco pad" (a sealed compact silver coated unit) for mounting on the HT220, HT100 or almost any other hand unit made. I acquired one of the latter specifically modified so that actuating a microswitch on the side of the pad converts the third vertical row to the forth row using 1633Hz for additional control function. Unlike the Trim-line pad, this unit is more appropriately sized and covers about 65% of the surface area of the back of the HT120.

The pad I chose is the "sealed Tesco pad," which I highly recommend if you are going to use it with a hand unit of any type. One of the primary problems in adapting the new hybrid Touchtone chips, such as this Waller pad uses, to ham use has been radio frequency interference. Of course if your needs are for a pad mounted on a dashboard, or with a base station,use of the standard kit or wired form is great. In a talkie however, the rf is within inches of the chip and RFI can cause the chip to change frequency and output level.

Initial tests with a chip mounted in an HT220 required extensive rf bypassing by trial and error to achieve a reliable tone output. Waller has gotten around this problem by producing a special RFI shielded package designed especially for hand units. The completed unit consists of the switch assembly and a machined piece of aluminum stock that provides mounting room for the integrated circuit, a tone level pot, and a row switching microswitch (optional). In this sealed pad the IC is actually removed from its case to make the package even smaller. After all the components are mounted, wired, and tested, the unit is potted, and then silver coated for rf isolation. No further shielding or isolation should be necessary.

As is the case of the PL board, the installation is very simple. One wire connects

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to the transmit switch 14V, one to ground and one to the audio input. The pad comes with four tapped holes and matching hardware for mounting on various talkies. In the HT120 installation only the top two of these screws are used since the pad must be mounted on the rear of the talkie over the battery. To mount the pad this way we must modify the battery so that we can remove it by pulling it straight downward rather than lifting the bottom out as it was originally designed. To accomplish this first remove the clip from the battery, hold down the screw so it can be unscrewed all the way. Secondly, cut off the ridges at the bottom of the antenna slot on the underside of the battery pack that inhibit the battery from being pulled straight down. Once you are sure that you can move the battery in and out without first having to lift the bottom away from the talkie you are ready to mount the pad.

After removing the back from the talkie drill two holes, one in each niche on either side of the antenna slot. These holes are as close as practical to the battery compartment. One additional hole must be drilled to accept the three color coded wires. On my HT120, due to the curvature of the rear of the unit, I had to make two other alterations to make the bottom of the pad fit flush with the battery pack without any bottom pad mounting hardware. First, I used a small shim properly positioned between the two mounting screws to tilt the bottom of the pad towards the talkie so it exerts slight inward pressure against the battery. Secondly, since the case bulges out slightly I marked where the outline of the pad meets the battery, and within those limits, I carefully ground away a tiny pit of plastic by trial and error until I could slip the battery in under the pad with a flush all-around fit.

Now with the hardest part behind, simply connect the three wires as illustrated in the supplied data. Leads should be kept as short as possible, but that is the only precaution necessary. The audio level is easily adjusted through a hole in the side of the pad without having to disassemble anything.

. . .K6VGP

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Box 95
Waldron IN 46182

Ralph Taggart WB8DQT
4515 Oakwood
Okemos MI 48864

SSTV - ISB

Transmit video on one sideband and audio on the other.

Independent Sideband (ISB) is authorized to be used by amateur radio stations. This is a method of transmitting and receiving two signals on the same frequency. Regulations permit the transmission of voice on one sideband and video on the other sideband of one carrier frequency.

There is nothing particularly complicated about the generation and demodulation of ISB signals. There are many handbooks published on "sideband." With this information available as a guide it is easy to build equipment to generate and receive ISB or to add equipment to your present transmitter and receiver.

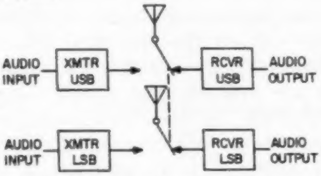

AUDIO INPUT
XMTR USB
RCVR USB
AUDIO OUTPUT
AUDIO INPUT
XMTR LSB
RCVR LSB
AUDIO OUTPUT

Fig. 1. Independent sideband using two transmitters and two receivers.

One of the easiest methods of transmitting and receiving ISB is to use two single sideband transmitters and two single sideband receivers which are tuned to the same frequency. Several slow scanners, who have the equipment, have used this method to generate and receive ISB. Fig. 1, shows the method where one transmitter and one receiver is tuned to the upper sideband and the other transmitter and receiver is tuned to the lower sideband.

Figures 2 and 3 show the method used at W7FEN's station to generate and receive ISB using a KWS-1 transmitter and a 75A4 receiver. This required a minimum of modification to the transmitter and receiver. The KWS-1 transmitter only required a small wiring change, the addition of a relay and a small switch. The switch was mounted in place of the dial drag knob shaft. A cathode follower was added to the 75A4 receiver on the chassis at the center rear.

The relay switches the transmitting ISB exciter to the 250 kHz injection plug in the

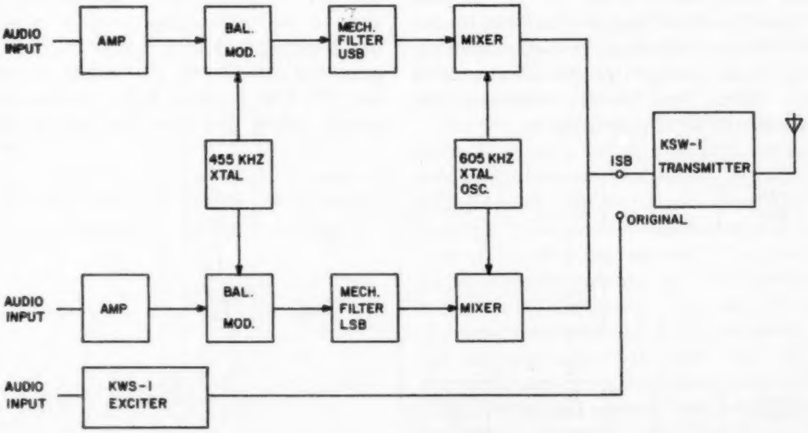
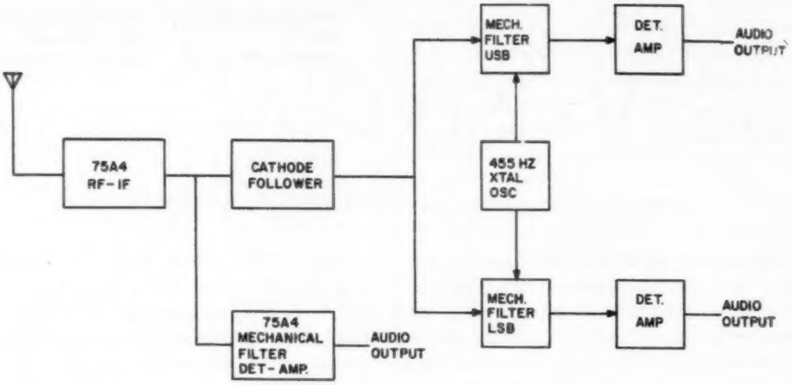

AUDIO INPUT
AMP
BAL. MOD.
MECH. FILTER USB
MIXER
455 KHZ XTAL
605 KHZ XTAL OSC.
ISB
KSW-I TRANSMITTER
ORIGINAL
AUDIO INPUT
AMP
BAL. MOD.
MECH. FILTER LSB
MIXER
AUDIO INPUT
KWS-I EXCITER

Fig. 2. Addition of ISB adapter to KWS-1 transmitter.



75A4
RF-IF
CATHODE FOLLOWER
75A4
MECHANICAL FILTER DET-AMP.
AUDIO OUTPUT
MECH. FILTER USB
455 HZ XTAL OSC
MECH. FILTER LSB
DET. AMP
AUDIO OUTPUT
DET. AMP
AUDIO OUTPUT

Fig. 3. Addition of ISB adapter to 75A4 receiver.

KWS-1 transmitter. In this way the KWS-1 transmitter may be used either as original or with the addition of ISB. The ISB adapter was constructed from surplus units using separate upper and lower sideband mechanical filters.

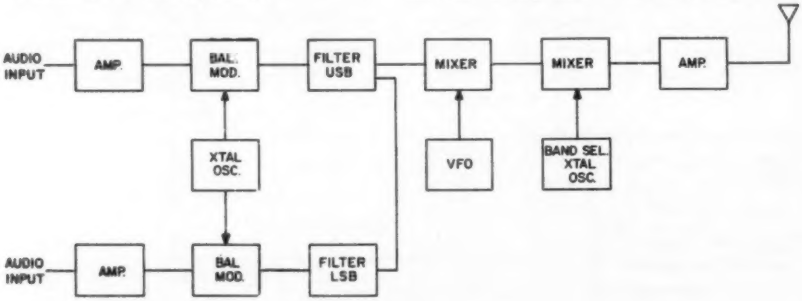
To use the ISB adapter with the 75A4 receiver it is only necessary to turn the audio gain control to minimum and set the bandpass tuning to zero. Thus the 75A4 can be conveniently adjusted from the original 74A4 SSB to the ISB adapter. The adapter for ISB was also constructed from surplus units using separate upper and lower sideband mechanical filters. We are looking forward to obtaining a 6 kHz filter for the 75A4 receiver and using the output from the Q multiplier to feed the ISB adapter. With three filters, two for each sideband, the 75A4 should be extremely sharp.

A block diagram for ISB transmitter and ISB receiver is shown in Figures 4 and 5.

Some may wish to refer to Fig. 6 and dig out their old Central Electronics Sideband Slicer to modify it to receive ISB. A little rewiring with the addition of a 12AT7 and an out-boarded audio amplifier and speaker will convert a receiver to ISB.

Filters for upper and lower single sideband are available and usually from the manufacturer of the filter found in the equipment you wish to convert to ISB.

Of course it is no problem to obtain crystals for the i-f frequency required. Those transmitters using i-f frequencies which differ from the frequency of the filter you may wish to use, will require a mixer. A mixer was required in Fig. 2, where the ISB was generated at 455 kHz and mixed to obtain the 250 kHz required in the KWS-1 transmitter. Using 250 kHz mechanical filters



AUDIO INPUT
AMP.
BAL. MOD.
FILTER USB
MIXER
MIXER
AMP.
XTAL OSC.
VFO
BAND SEL. XTAL OSC.
AUDIO INPUT
AMP.
BAL. MOD.
FILTER LSB

Fig. 4. ISB transmitter block diagram.

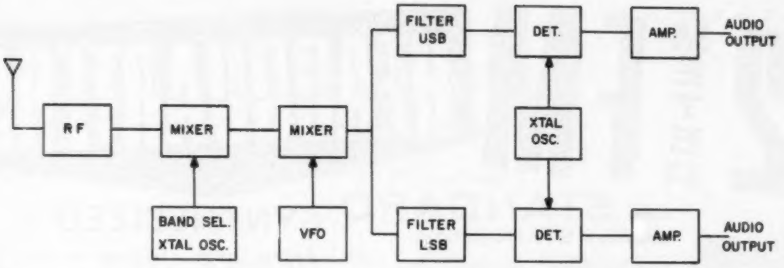

FILTER USB
DET.
AMP.
AUDIO OUTPUT
RF
MIXER
MIXER
XTAL OSC.
BAND SEL. XTAL OSC.
VFO
FILTER LSB
DET.
AMP.
AUDIO OUTPUT

Fig. 5. ISB receiver block diagram.

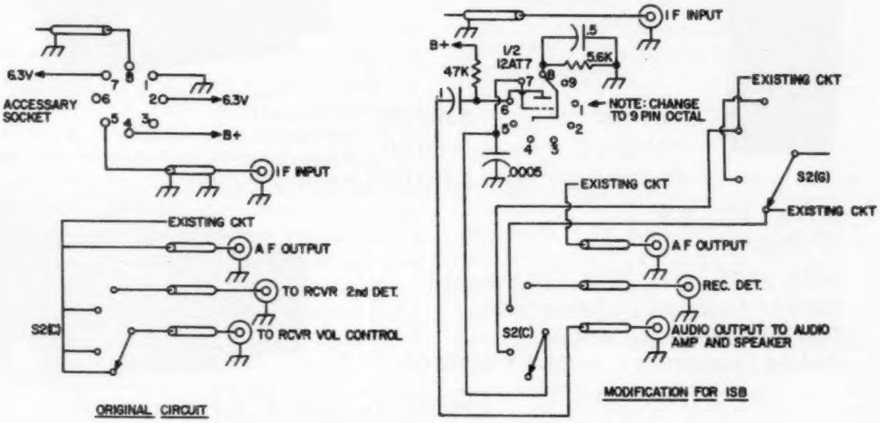

6.3V
ACCESSARY SOCKET
6.3V
B+
IF INPUT
EXISTING CKT
A F OUTPUT
TO RCVR 2nd DET.
S2(C)
TO RCVR VOL. CONTROL
ORIGINAL CIRCUIT
IF INPUT
B+
47K
1/2 12AT7
.5
5.6K
NOTE: CHANGE TO 9 PIN OCTAL
.0005
EXISTING CKT
EXISTING CKT
S2(G)
EXISTING CKT
A F OUTPUT
REC. DET.
S2(C)
AUDIO OUTPUT TO AUDIO AMP AND SPEAKER
MODIFICATION FOR ISB

Fig. 6. Central Electronics Inc. Sideband Slicer Model A.

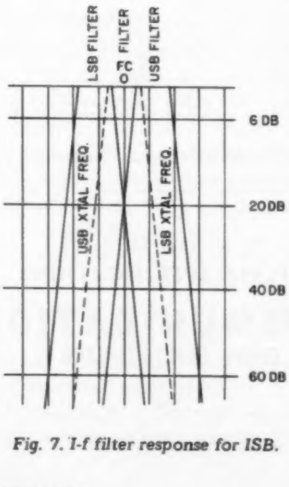


Fig. 7. I-f filter response for ISB.

would not have required the changing of the frequency. It was no problem in the 75A4 receiver since its i-f frequency is 455 kHz with tunable bandbass.

We are not going into great detail because there is so very much published on single sideband exciters. Each piece of equipment to be modified has its own requirements. Starting from scratch only requires two separate exciters or demodulators, one for upper sideband and one for lower sideband. Note that the sideband filters are designed for only the upper and lower sidebands for use with one carrier frequency. Fig. 7, shows the method. Although a phasing type exciter could be built to generate ISB we have some reservations about its performance.

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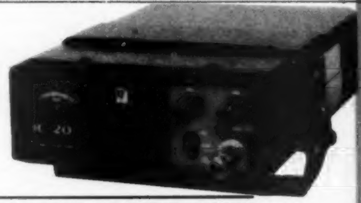

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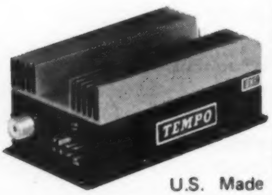

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1002-3B	1-2.5 watts	120-130 watts	$235
802	5-12 watts	70-90 watts	$180
802B	1-2.5 watts	80-90 watts	$195
502	5-15 watts	35-55 watts	$105
502B	1-2.5 watts	45-50 watts	$130
302B	1-2.5 watts	30-35 watts	$ 99

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THE ELUSIVE 100 COUNTRIES

A few weeks ago a friend of mine who recently passed his Canadian examination for his "Advanced Amateur" ticket and could now use phone, asked me this question, "Is it possible to work 100 countries today with propagation conditions not very good?"

My answer was, "Yes, it is possible to do this today, but it is quite a bit more difficult now than it was 12 months ago!" While not impossible, it requires more analysis and thinking. The results give one quite a thrill, after analyzing the problem, making decisions and finally having the ultimate QSO and receiving a QSL card. Adding the call to your list is fascinating, as is the interest in watching the number of elusive countries grow to the magic figure of one hundred.

This article is based on the information I gave my friend and perhaps it might be of value to amateurs who are interested in obtaining the coveted award.

There are two methods of attacking the problem:

1. Random listening
2. Planned listening

Random listening takes a great deal of time and does not, generally, produce good results. For example, it's not much use listening for a country when the amateurs in that country are asleep! It would be much more efficient to plan the attack and to operate within certain known parameters.

Planned listening will produce results. We need to know such things as:

1. Countries we could normally expect to contact.
2. The time when we could expect amateurs in the distant country to be operating. Such time must be in terms of Greenwich Mean Time (GMT).
3. Propagation knowledge is essential. When is the path between your QTH and the country you wish to contact most favorable?
4. Bands and antennas must be considered and the best one used for your purpose.
5. QSL's and obtaining them is sometimes a problem. Certain aids are available to help us here.
6. Schedules for difficult countries can be arranged. Again, aids are available to help the amateur. DXpeditions, for example, can be quite helpful.

Let us look at these six items in detail.

Countries

If we look at the World Map we note immediately that there are many countries quite close to the United States and Canada. The Caribbean, for example, has quite a number of countries in it.

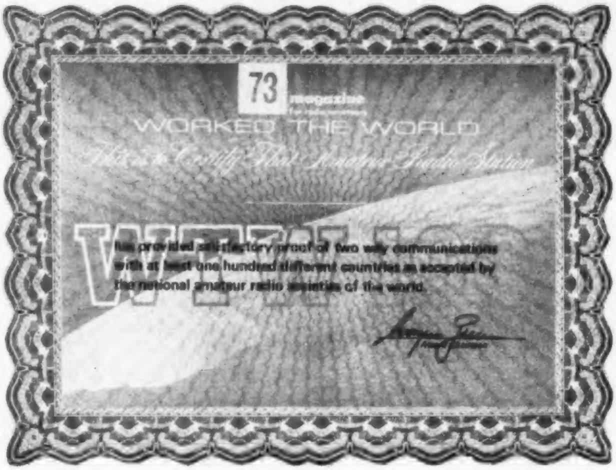
Let's list them as follows:

Country	Call	Country	Call	Country	Call
1	VE/VO	14	HH	26	VP2K
2	W/K	15	KG4	27	VP2L
3	KL7	16	KP4	28	VP2S
4	XE	17	KV4	29	VP2
5	TG	18	FS7	30	FM7
6	YN	19	FG7	31	8P6
7	YS	20	VP2E	32	PJ
8	TI	21	VP2A	33	ZF1
9	HP	22	VP2V	34	CM/CO
10	KZ5	23	VP2D	35	6Y5
11	VP1	24	VP2G	36	VP5
12	FP8	25	VP2M	37	VP7
13	HI				

So, quite close to us there are 37 countries which we should be able to work without much difficulty.

Next let us look at South America. Look for these countries after 2200 GMT.

Country	Call	Country	Call	Country	Call
38	HK0	43	PZ	47	LU
39	HK	44	OA	48	CE
40	YV	45	PY	49	ZP
41	9Y4	46	CP	50	CX
42	8R				



73 magazine

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Out in the Atlantic Ocean there are several countries of interest. Several of the ZD7-8 amateurs work in the cable relay stations, listen for them after 1900 GMT.

Country	Call	Country	Call	Country	Call
51	VP9	53	ZD8	54	CT2
52	ZD7				

In the British Isles, Northern Ireland and Ireland we have the following (Try 1600-1800 GMT for these.):

Country	Call	Country	Call	Country	Call
55	GM	57	GI	59	G
56	GW	58	GD	60	EI

There are a number of countries in Europe which we can listen for and work. Listen about 1600-1800 GMT for them.

Country	Call	Country	Call	Country	Call
61	LA	68	ON	75	YU
62	SM	69	F	76	YO
63	SP	70	I	77	EA
64	OH	71	HB	78	EA6
65	OK	72	HA	79	SV
66	DL	73	OE	80	CT1
67	PA	74	OZ		

In Africa the political situation is having an effect on radio amateurs in many of the countries. But here are some calls to listen for (Listening for this group varies widely, try 1500-1800 GMT.):

Country	Call	Country	Call	Country	Call
81	ZD3	86	EA8	90	5H3
82	ZE	87	CR7	91	5N2
83	ZS	88	CR6	92	EL
84	ZS3	89	9Q5	93	CT3
85	A2C				

You will note the absence of certain countries in these lists. They are not included in this analysis because they are quite difficult to contact due to time differences, propagation, other conditions or possibly due to the fact that there may be few amateurs in the country. From time to time, there may be no amateurs in a particular country. Some locations, called countries, have no people living on them – hence DXpeditions, if they can be financed.

In the Pacific area we have the following (Try listening about 1200 GMT and also 0300-0500 GMT.):

Country	Call	Country	Call	Country	Call
94	ZL	96	VK9	97	5W1
95	VK				

In Asia we have:

Country	Call
98	JA

So, now we are up to 98! Let's add a few more.

Country	Call
99	ET3

We haven't mentioned the U. S. S. R. yet. There are a number of provinces, each classified as a country. Often the best plan is to work them on CW. You might also listen for 5B4-ZC, LX, LZ, GC and ZB2.

Time

Every amateur interested in DX should have a late copy of the *Callbook*. Cut out the "World Time Conversion Chart In Hours," paste it on a piece of cardboard and check what the local time is in the country in which your are interested. Try to figure out when the amateurs in that country will be operating. Many operators "sit in" in the early morning before they go to work and immediately after dinner time.

Propagation

Remember that between the Spring Equinox and the Fall Equinox the North-South path improves. So, during our summer look for South Africa, South America, Australia and New Zealand. Between the Fall Equinox and the Spring Equinox the East-West paths improve so next winter work Europe and Africa and the JA's.

Mark your desk calendar with the propagation estimates of each month by Mr. J. H. Nelson, second to the last page of each month's issue of 73 Magazine.

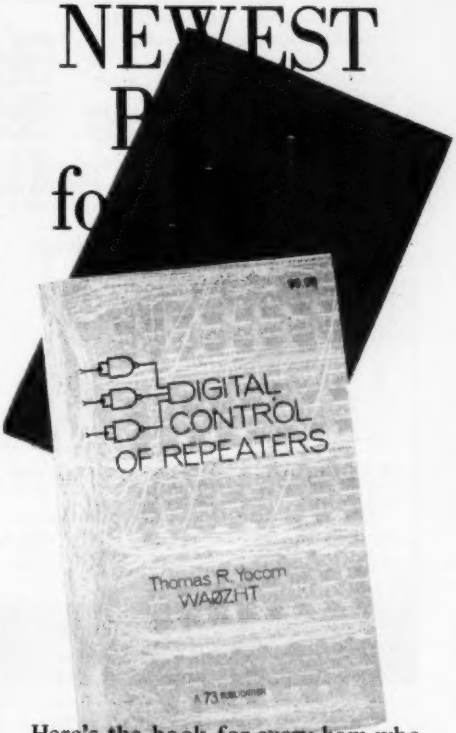
Bands and Antennas

These must be considered in detail. 20m seems to be the best band now, with 40m very useful. If you haven't a beam or a quad, construct one. There are many construction articles and several good books on inexpensive beams and quads. Also, put up a good 40m dipole, fed with low loss cable or twin lead. Make sure your antennas are resonant where you want to work. Make your antennas as efficient as possible.

QSL Cards

If QSL cards come via some bureaus, several years might elapse before you receive a particular card. My preference is to arrange for the QSL during the QSO, then airmail your card with an SASE containing the proper number of IRCs. Let's make it easy for the distant amateur to QSL to you.

NEWEST
B
fo



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Schedules

These can often help you greatly. Schedules with difficult countries can often be arranged through a QSL manager, if the distant amateur has one. Watch the various radio magazines for their DX column and read these columns thoroughly. Make a list of the needed calls with the notation as to who the QSL manager is. The QSL Managers Directory, published by W6GSV can be very helpful to you since it includes the addresses of the QSL managers.

Write to the QSL manager, again being careful to include an airmail envelope, self-addressed, with the proper number of IRCs. Ask him if he can arrange a schedule for you. If he receives only the logs and QSL cards ask him to advise you when his amateur is usually operating and what frequencies he likes to use. It will cost you money for the IRCs and airmail, but often it is the only way to find out what you want to know.

Another suggestion is to get acquainted with the various nets. Talk to the Controller and find out if the country you're interested in reports in to the net. You may be able to have a QSO through the net.

Various DX bulletins are produced regularly, the cost being nominal. Some of these are Long Skip, LIDXA, WCDXB, Geoff Watts news sheet, Gus Browning's (W4BPD) weekly DX Magazine, West Coast DX Bulletin. If you study these you can build up a table of operating times and frequencies and QSL data for amateurs in a desired country.

Serious DXers subscribe to one or more of these DX bulletins. They are invaluable also in that they tell you of coming DXpeditions, usually giving frequencies, modes and times of operation.

Conclusion

This is basically the information I gave to my friend. I hope you learned something from reading this article and that it will help you in your search for the "Elusive 100 countries." I wish you the best of luck and success.

. . . VE3CEA

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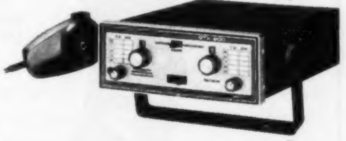

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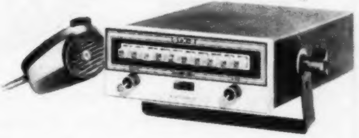

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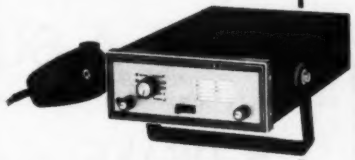

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CLASS B COMPLEMENTARY PAIR

Many of you have encountered the words "complementary pair" and on occasion have come across "complementary-symmetry output stage." Perhaps you shrugged it off with the notion you would return at some later date to learn more about this particular use of transistors. I did return.

The Search

As I searched for practical information regarding this transformerless Class B audio circuit, it became clear that few circuit designers take the time to do more than star (*) those two transistors and add a footnote telling you these ' must be factory matched pairs." The average well adjusted person would accept this and not bother to learn a bit more about why they should be matched pairs. After all, portable radio sets and economy model hi-fi amplifiers use them; they work. Who cares why? As a matter of fact, phono-amplifier modules, bought for less than $5, deliver about 1W output power at low distortion levels. Reason told me to let well enough alone. I'm unreasonable.

The Circuit

I chose a relatively simple circuit from an old Sears & Roebuck company portable receiver. I built it in duplicate for stereo use. The cost of the experiment was small and the pleasure of accomplishment was great. At the same time I learned something about matching complementary pairs. A piece of Vectorboard about 15 x 20 served as the chassis. The photographs are a clear indication of parts placement. The circuit is shown in Fig. 1. Readily available components were used. Miniaturization was not considered. The channels went together easily. I built the left channel first, probably because I'm left-handed. Use of transistor sockets is a must. This is particularly true if, as I have, you have several sacks of bargain transistors bought from *73* advertisers Poly Paks and Meshna stashed away waiting to see if they are compatible and can work as complementary-symmetry pairs. The transistors selected for the circuit I've shown work well at amplification levels from about 1/10 to 1/2W into a 16Ω speaker.

Selecting Transistors

Preliminary selection was made by using a transistor tester built from information contained in an article by Frank Jones W6AJK which appeared in the September 1966 issue of *73* Magazine. This tester provides an

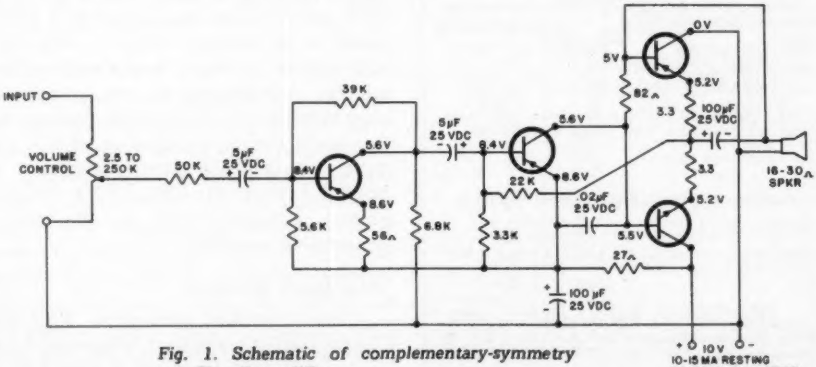

Fig. 1. Schematic of complementary-symmetry pair Class B amplifier.

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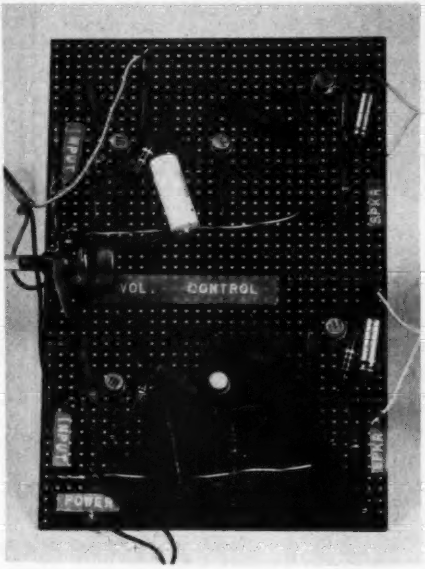
approximate amplification factor when you divide the indicated base current into the indicated collector current. I found that when the NPN and PNP's showed similar dc characteristics, they generally worked as complementary pairs. The PNP transistors used in this experiment are 2N404's. The single NPN in each output stage is a 2N385. If the 2N385 is not available, 2N1206's can be substituted. Other NPN's work in this circuit but not as well as the combinations mentioned. I did not have newer types on hand to try. That is why I chose the 1963 circuit. The transistors used are germanium medium service switching types with an upper frequency limit of 4 MHz.

Testing the Circuit

With 0.5V input, the complementary pair will drive a 16 or 30Ω speaker to at least ½W music power. That doesn't sound like much power, yet in an average room, it is more than a person with sensitive hearing can comfortably stand for any length of time. A 10V supply such as shown in Fig. 2 was connected and power applied. I touched an input terminal with my forefinger to see if there might be some 60 cycle buzz getting through. To my utter surprise, music came burbling from the speaker! (Secret smile and fleeting thought – I knew I had music in my soul, but *finger tips*? There sure is a lot of life in the old boy yet!) Soon the announcer of the local radio station was heard and the fleeting thought disappeared. Well, now, here is an unexpected bonus. A radio set with no tuned circuits. Different lengths of clip leads were hooked to an input terminal until useful volume was achieved. (I had not wired in the volume control.) Here was a high quality test signal with which to check out the complementary pairs without the need to hook up a turntable and flip records. Our local station provides about 0.1 Voltmeter of radio frequency energy at my house. Testing of PNP–NPN's began in earnest. Needless to say, a wide range of distortion is available!

Close Match Required

Close matching betweeen PNP–NPN Class B output transistors is required for the reason that each transistor is driven by the

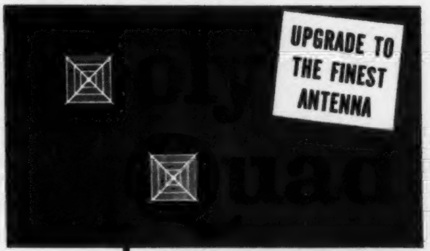


Top view, complementary-symmetry pair Class B, stereo amplifiers. Photo by Dan Elliott Photo Shop.

same input signal. They respond oppositely to this signal. Any substantial difference in the characteristics of the output pair, such as leakage current, will result in discontinuities at the crossover point for the positive and negative half cycles. When the two half cycles of the amplified waveform do not accurately fit together, high order harmonics are produced which result in discordant speech or music. This is heard as highly objectionable distortion.

No Fly-wheel Effect

In the complementary-symmetry pair circuit there is no transformer to provide a "fly-wheel" effect which might help smooth the crossover swing. Therefore, careful choice of bias must be arranged. Appreciable idling current must flow to assist in avoiding crossover distortion. This type of distortion becomes noticeable in portable receivers when the battery voltage falls below the level which upsets the bias voltage for a given pair of transistors. The circuit I've shown works well between 6 and 10V.



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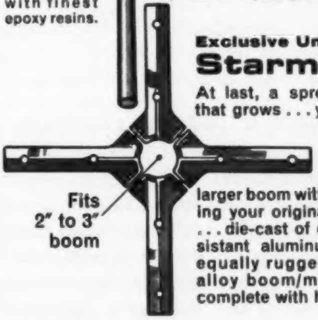

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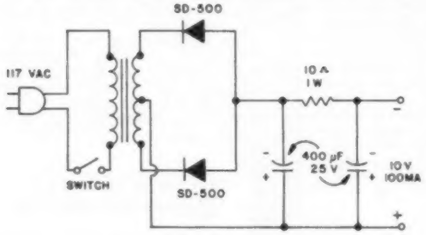

Fig. 2. Schematic of 10V 100 mA power supply.

Reducing Distortion

Those who have worked with Class B tube amplifiers will recall that it was often desirable to place a few volts of positive bias on the grids to aid in reducing crossover distortion. In many transistor circuits a similar scheme is found. This circuit is no exception. A bit of forward bias is used between base and emitter (in the low resistance direction) to overcome crossover dead time and make the amplifier a great deal more linear at all listening levels. In addition, ac and dc feedback is used to improve linearity and to extend the upper frequency limit. Resting current is about 5 mA per channel and depends on the supply voltage. This is perhaps more resting current than is actually needed, and I believe the complementary pair is running Class A at low input levels. The 2N404 and 2N385 data sheets indicate 25V maximum supply to the transistors. That voltage would require more heat sink than I show. 10V is a good compromise. I tried 15V and the 3.3Ω resistors in the emitters were barely able to keep the transistors out of thermal runaway. In 30 minutes the resting current slowly climbed to a higher value. The resting current was also sensitive to temperature. At 50°F and 15V, the transistors tolerated the supply voltage. At 75°F room temperature, they did not and began to show thermal runaway. A vacuum tube voltmeter was used to obtain the voltages shown in the schematic.

Surprise

This investigation of complementary-symmetry circuitry was not without other surprises. For instance, the right channel

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broke into a magnificent howl when the volume control was backed off to zero. Apparently the input was effectively connected to the output through some sneak circuit and the feedback loop caused an oscillation which drew more than 100 mA from the 10V supply. This happened only when both channels were in use. Each separately was stable. I didn't check out the howl more than twice because the transistors are rated at 150 mW dissipation. The cure for the trouble wasn't especially scientific, but it was adequate. a 50 KΩ resistor was placed in series with the input base coupling capacitors and the arm of the volume control. This affords a measure of isolation. At the moment I don t know how to prevent such unwanted coupling.

Advantages

An attractive advantage of the PNP–NPN completmentary-symmetry pair is that it can be driven by a single driver transistor. This eliminates the need for phase inverters and/or transformers. Direct coupling between transistors can be used to improve the frequency range. Biasing can be done through the use of conventional resistors.

Conclusion

Simple methods can be used to select transistors for Class B transformerless work. A good starting point can be found in one of *Transistor Substitution Handbook No. 9*. It is advisable to have several transistors of the same kind on hand in order to select those which will work well together. Proper biasing is most important for good linearity with least distortion in the output signal. The new silicon planar transistors are good candidates for complementary-symmetry pair work. From what I can find in the literature, just about all silicons can be used for audio work without regard to their maximum frequency capability. Their low leakage allows direct coupling of audio stages without complicated temperature compensation. Thus a transformer can be eliminated. The major change required is biasing so as to provide about 0.6V base-emitter drop instead of the 0.2V needed for germanium transistors. I plan to try silicons next.

. . .W5SOT

LETTERS

REJECTED LICENSE

I think the time has come to voice my feelings in amateur radio's public print regarding the current status of the FCC's procedures and practices in the area of amateur radio.

For the past 27 years I have been actively involved in radio broadcasting in the engineering and technical phases. During these years I have had ample opportunity to observe the operations of the commission in both the rule-making and regulatory areas. I have never before been as disturbed and uncomfortable as I am now.

This letter is really prompted by the recent rejection of my application for a repeater license by the Washington office of the commission. That rejection has made me stop and think about just what it is that the commission is trying to achieve, and frankly, I fail to understand either it's goals or it's motivations.

As chief engineer of several radio broadcasting operations, including both FM and AM directional stations, I thought that I was in reasonably good condition to present to the commission an application which would be properly set in engineering terms and timely filed. But, apparently I was wrong. The paperwork that I hand carried to Washington ended up in the circular file. The commission, in it's infinite wisdom, did not accept the antenna that I had selected and installed some two years ago, on one of the towers of the AM directional station for which I am responsible. The installation of the antenna was accomplished during some major structural changes to the broadcast system, for which a major proof-of-performance was required on the directional array. I might add that the antenna which I chose and the commission subsequently rejected for lack of type approval is in widespread and common use in the commercial FM mobile radio service for base station applications. But, oddly enough, this antenna does not appear on the mysteriously-generated approved list of the commission.

The question that intriques me is not the commission's reasons for refusing to accept this particular antenna, but rather why the commission has burdened the amateur radio service with approval requirements not deemed necessary in the commercial services. The sad facts for me are that by strict interpretation of the commission's rules, I cannot even remove the antenna from the tower to attempt pattern measurements because that action would immediately generate a problem with the broadcast bureau, to whose rules I am bound regarding the operation and maintenance of the directional array.

After careful consideration I have arrived at the point where I am forced to wonder about the intentions of the gentleman who directs the attitudes and activities of the amateur and citizen's division. What the hell are they trying to prove? Are they not aware that they may be implimenting attitudes that could eventually destroy amateur radio if permitted to continue unchecked along the courses now being pursued????

It is reasonable to question the motives and methods of the individual who directs that division when one examines the manner of grossly restrictive rulemaking being foisted upon the amateur radio fraternity, and compare the same division's activities and attitudes towards it's other area of responsability, the citizen's radio service.

While it is obvious that the people in the broadcast bureau get their paychecks from the same coffers as the people in the amateur and citizen's division, it is also obvious that they don't talk to each other in terms of common policy guidelines and philosophy. The latter organization continues to blithely ignore the widespread malpractice, violation, and chaos rampant in the citizen's radio service, which it is also required to administer, while it concentrates huge efforts on what seem to many of us to be open attempts to put amateur radio out of business. Again I ask what the hell are they trying to prove? To require the amateur radio service to follow rules and procedures not required of comparable commercial services smacks of some kind of perverse thinking. It certainly deserves, if nothing more unflattering, the title of discriminatory treatment.

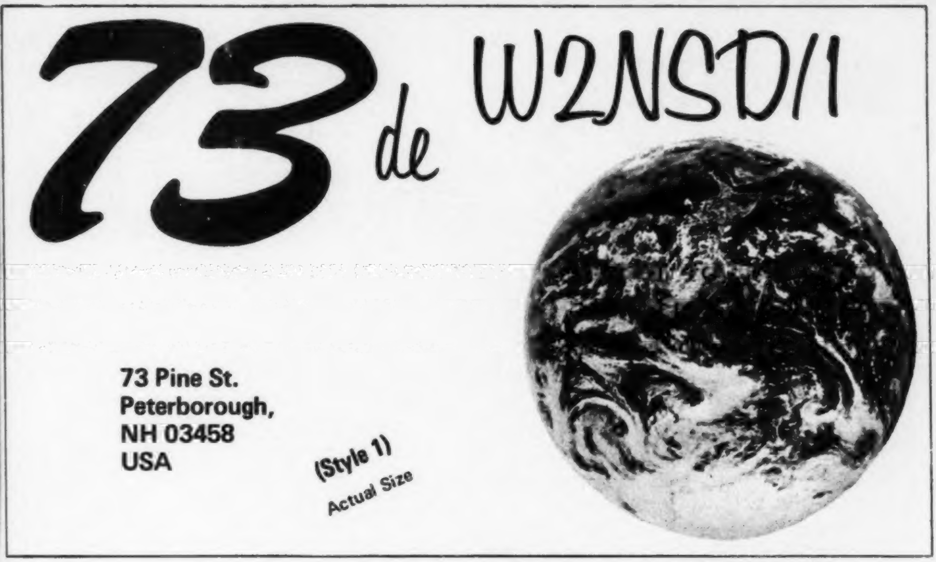
But again I ask not what they are doing. . .rather, why are they doing it? Is not the commission as a whole bound to be zealous of the public interest? Are not these people paid from our own pockets, servants of the public and thus subject to our overseeing and inquiry as to their actions and attitudes? I, for one, say yes and amen. I am paying their salaries. I am needful of their services. And as their employer, I say that the time has come to demand a full and extensive inquiry into the activities of the men who are at the head of the amateur and citizen's division.

The question I raise is not what they are doing. . .that is obvious. I want to know why they are doing it and what factors are the basis for their totally inequitable attitudes and actions of the past two years.

During these same past two years, we in the broadcasting business, have watched while a series of strikingly well thought out new regulations issue forth from the broadcast bureau. . .rulemaking which is infused with the realization that the state of the broadcaster's art had advanced to the point where the exisiting rules were in dire need of revitalization. And while there is little doubt that the new rulemaking in the broadcasting bureau has much lobby pressure from the industry behind it, it is difficult to find any strong or serious opposition to the sweeping reregulation that has been legislated into broadcasting. Many sacred cows of broadcast law have been swept into the musty archives of history in the past two years. . .the first class radiotelephone license has, for all practical purposes, been delivered to the tender care of the Smithsonian Institute since it is no longer required for anyone except the chief engineer. The old hassle of taking transmitter readings for the operating logs on a half-hourly basis has been relegated to oblivion and stations of all categories, up to and including fifty kilowatt directionals are now permitted full remotely controlled unattended operation with readings to be taken at intervals up to three hours. The previous requirement of daily inspection of the transmitter site has been relaxed in the simpler cases to once every five days, and in the more stringent cases of the remotely-operated high power directional station, to once every fifty-four hours. The old saw of station identification every thirty minutes within two minutes of the hour or half hour has been relaxed to once an hour as near to the hour as is consistent with normal breaks in programming. I could go on ad infinitum quoting a long series of changes and deregulation of the past two years, but I think my point is clear.

I have been pained to see, in the past several years, an unhealthy schism develop within the ranks of amateur radio. Factions dividing the fraternity have served only to generate animosity among us — the spirit of amateur radio. Further, that schism has caused many of us to forget the true goals which amateur radio originally set out to achieve. In useless bickering among ourselves and between the various factions, we have lost track of what we are and where we should be going. We have lost that immense power that lies in unity and

Cont. on page 111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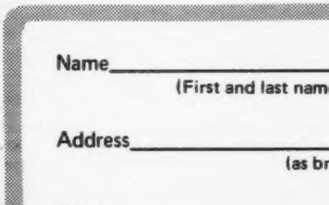
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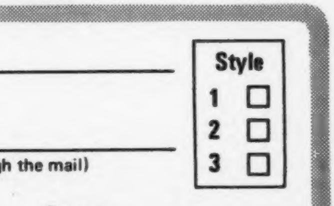
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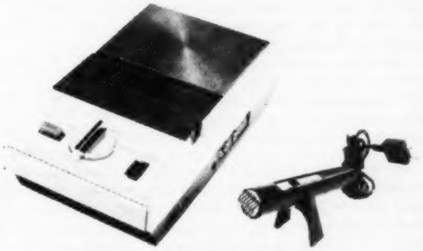

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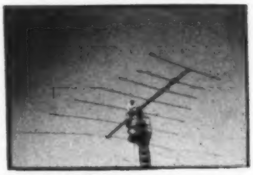

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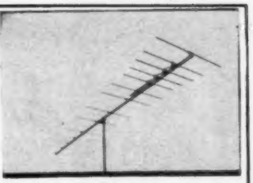

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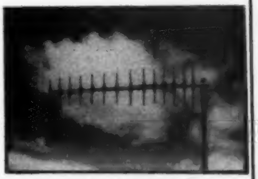

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Cont. from page 4.

up with those fantastic numbers in their suits against small businesses – and you can see how so few of them are able to do anything about it except try the best they can to settle – and that means pleading guilty, whether you are or not. It gives the IRS a nice record, but it leaves a lot of bitter people who find few ears willing to listen to their troubles.

By disallowing things that seem like obvious business expenses they can build up a frightening suit against the small businessman. And the first hint that there is anything serious breeding can come as an announcement in the newspaper that you have been indicted for fraud by a grand jury. When you try to find out what the IRS could possibly have told a grand jury to result in this you discover that all doors are closed – you have no way of finding out what was claimed against you other than the amount they claim you and your business owe.

The first hint I had that anything was afoot like this was when someone called to say that the local radio station had a news item that morning that I had been indicted by a grand jury on twelve counts of criminal fraud and that the amount involved was over $100,000. Then it appeared in the paper – and a fellow publisher made sure that all advertisers were aware of the IRS side of the story by sending out photo copies of the newspaper article. One of the ham publications rushed right into print with it– but just the IRS story.

It was quite a few days before I got a copy of the indictment – and even then I didn't know much more. The twelve counts sound dramatic, but actually the IRS disallowed business expenses for the three years 1966-67-68, and they are able to escalate that into twelve counts. It sounds better to the public – and that is apparently the whole object of their scheme – to impress the public and make them afraid of the IRS.

They euphemistically call it the Taxpayer Compliance Program - and the game seems to be to take one defenseless pigeon and call in hundreds of witnesses to the crucifixion so they will all go home and spread the word not to fool with the IRS.

The Watergate mess gives a hint as to how these Gestapo type people operate. They appear to live in a world where anything goes, no matter how dirty or illegal – where postal surveillance means opening your mail and checking it – where wire taps are an everyday occurrence - where frightening witnesses into saying things is the norm. They have their own investigators – their own lawyers – their own courts – and unlimited budgets to crush anyone who tries to stand in their way.

The fear of persecution has kept the press from printing much in the way of IRS horror stories – but every now and then one comes to light where some individual has fought for years through their rigged courts before winning what should have been an open and shut case of acquittal on trumped up charges.

Well, you might say, why didn't you explain what the reasoning was for the business expenses when they examined you? Brother, they never ask you – they just make up their mind, with no comeback possible from you unless you can stand the cost of a jury trial and a very long bitter fight.

And going to trial is something else again, for here you need to line up some expert witnesses to testify about tax matters. Do you know that it is virtually impossible to get anyone on the witness stand, for any money, to do this? The experts are so frightened of IRS retaliation that you can't get them to help you. They've heard all about accountants who have been so persecuted by the IRS that they have committed suicide or died of heart attacks – of firms where every client

(continued on p. 109.)

FCC RULES AND REGULATIONS, PART 97 (VI)

CONTENTS THIS MONTH

STATION OPERATION AWAY FROM AUTHORIZED LOCATION

97.95 Operation away from the authorized permanent station location.
97.97 Notice of operation away from authorized location.
97.101 Special provisions for mobile stations aboard ships or aircraft.

LOGS

97.103 Station log requirements.
97.105 Retention of logs.

EMERGENCY OPERATIONS

97.107 Operation in emergencies.

OPERATION OF ADDITIONAL STATIONS

97.108 Operation of a remotely controlled station.
97.109 Operation of a control station.
97.110 Operation of an auxiliary link station.
97.111 Operation of a repeater station.

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

STATION OPERATION AWAY FROM AUTHORIZED LOCATION

§ 97.95 Operation away from the authorized permanent station location.

(a) Operation within the United States, its territories, or possessions is permitted as follows:

(1) When there is no change in the authorized land station location, an amateur radio station other than a military recreation or an auxiliary link station may be operated under its station license anywhere in the United States, its territories or possessions as a portable or mobile operation, subject to § 97.61.

[§ *97.95(a)(1) amended eff. 10-17-72; VI(72)-1*]

(2) When the authorized permanent station location is changed, formal application (FCC Form 610 for an individual station license and FCC Form 610-B for an amateur club or military recreation station license) must be submitted to the Commission prior to any operation and within 4 months of the move for the purpose of modifying the station license to show the new permanent station location. Operation at the new location is permitted under the license for the former station from the date the modification application is mailed until advised of Commission action on that application.

(3) For operations under subparagraphs (1) and (2) of this paragraph, advance notice, as required by § 97.97, must be given to the Engineer in Charge of each radio district in which operation is intended and the portable identification procedures specified in § 97.87 must be used.

(b) When outside the continental limits of the United States, its territories, or possessions, an amateur radio station may be operated as portable or mobile only under the following conditions:

(1) Operation may not be conducted within the jurisdiction of a foreign government except pursuant to, and in accordance with express authority granted to the licensee by such foreign government. When a foreign government permits Commission licensees to operate within its territory, the amateur frequency bands which may be used shall be as prescribed or limited by that government. (See Appendix 4 of this Part for the text of treaties or agreements between the United States and foreign governments relative to reciprocal amateur radio operation.)

(2) When outside the jurisdiction of a foreign government, operation may be conducted within Region 2 on any amateur frequency band between 7.0 MHz and 148 MHz, inclusive; and when not within Region 2, operation may be conducted only in the amateur

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NOTE: Region 2 is defined as follows: On the east, a line (B) extending from the North Pole along meridian 10° west of Greenwich to its intersection with parallel 72° north; thence by Great Circle Arc to the intersection of meridian 50° west and parallel 40° north; thence by Great Circle Arc to the intersection of meridian 20° west and parallel 10° south; thence along meridian 20° west to the South Pole. On the west, a line (C) extending from the North Pole by Great Circle Arc to the intersection of parallel 65°30′ north with the international boundary in Bering Strait; thence by Great Circle Arc to the intersection of meridian 165° east of Greenwich and parallel 50° north; thence by Great Circle Arc to the intersection of meridian 170° west and parallel 10° north; thence along parallel 10° north to its intersection with meridian 120° west; thence along meridian 120° west to the South Pole.

(3) Notice of such operation, in accordance with the provisions of § 97.97, shall be given to the Engineer in Charge of the district having jurisdiction of the authorized fixed transmitter location.

§ 97.97 Notice of operation away from authorized location.

Whenever an amateur station is, or is likely to be, in portable operation at a single location for a period exceeding 15 days, the licensee shall give advanced written notice of such operation to the Commission's office specified in § 97.95. A new notice is required whenever there is any change in the particulars of a previous notice or whenever operation away from the authorized station continues for a period in excess of 1 year. The notice required by this section shall contain the following information:

(a) Name of licensee.

(b) Station call sign.

(c) Authorized station location shown on station license.

(d) Specific geographical location of station when in portable operation.

(e) Dates of the beginning and end of the portable operation.

(f) Address at which, or through which, the licensee can be readily reached.

[§ *97.97 revised eff. 10-17-72; VI (72)-1*]

§ 97.101 Special provisions for mobile stations aboard ships or aircraft.

In addition to complying with all other applicable rules, an amateur mobile station operated on board a ship or aircraft must comply with all of the following special conditions: (a) The installation and operation of the amateur mobile station shall be approved by the master of the ship or captain of the aircraft; (b) The amateur mobile station shall be separate from and independent of all other radio equipment, if any, installed on board the same ship or aircraft; (c) The electrical installation of the amateur mobile station shall be in accord with the rules applicable to ships or aircraft as promulgated by the appropriate government agency; (d) The operation of the amateur mobile station shall not interfere with the efficient operation of any other radio equipment installed on board the same ship or aircraft; and (e) The amateur mobile station and its associated equipment, either in itself or in its method of operation, shall not constitute a hazard to the safety of life or property.

LOGS

§ 97.103 Station log requirements.

An accurate legible account of station operation shall be entered in a log for each amateur radio station. The log shall bear the call sign of the station and the signature of the licensee. The following information shall be recorded as a minimum:

(a) Written entries for all stations which are required only once, or when there is a change thereto.

(1) The signature of the control operator on duty and the call sign of his primary station, if he is other than the station licensee.

(2) The location of the station. Stations in mobile operation may enter the word "local" for amateur radiocommunication conducted within 100 statute miles of the address shown on the station license, otherwise the location of the first and last radiocommunication of each day. Stations in mobile or portable operation shall make an entry showing compliance with § 97.97, if required.

(3) The input power to the transmitter final amplifying stage.

(4) The type of emission used.

(5) The frequency or frequency subband used for transmitting.

(b) Other entries for all stations which may be recorded in a form other than written but which can readily be transcribed by the licensee into written form:

(1) The dates of operation.

(2) Except for repeater stations, names of persons other than the control operator using the station, either directly or indirectly, for amateur radiocommunication.

(3) A notation of third party messages sent or received, including names of all participants and a brief description of the message content.

(4) The call sign of each station actually contacted, or other purpose of the transmission, i.e., those set forth in § 97.89. Stations in mobile operation and repeater stations may omit this entry. Control stations shall enter the call sign(s) of each station in the control link. An auxiliary link station shall enter the call sign of its associated station(s).

(5) All stations shall enter the times the station is put into, or taken out of, service. Stations other than those in mobile operation, control stations, auxiliary link stations, and repeater stations shall enter the times of commencing and terminating each exchange of radiocommunication.

[*§ 97.103 revised eff. 10–17–72; VI(72)–1*]

§ 97.105 Retention of logs.

The station log shall be preserved for a period of at least 1 year following the last date of entry and retained in the possession of the licensee. Copies of the log, including the sections required to be transcribed by § 97.103, shall be available to the Commission for inspection.

[*§ 97.105 revised eff. 10–17–72; VI(72)–1*]

EMERGENCY OPERATIONS

§ 97.107 Operation in emergencies.

In the event of an emergency disrupting normally available communication facilities in any widespread area or areas, the Commission, in its discretion, may declare that a general state of communications emergency exists, designate the area or areas concerned, and specify the amateur frequency bands, or segments of such bands, for use only by amateurs participating in emergency communication within or with such affected area or areas. Amateurs desiring to request the declaration of such a state of emergency should communicate with the Commission's Engineer in Charge of

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the area concerned. Whenever such declaration has been made, operation of and with amateur stations in the area concerned shall be only in accordance with the requirements set forth in this section, but such requirements shall in nowise affect other normal amateur communication in the affected area when conducted on frequencies not designated for emergency operation.

(a) All transmissions within all designated amateur emergency communication bands other than communications relating directly to relief work, emergency service, or the establishment and maintenance of efficient amateur radio networks for the handling of such communications shall be suspended. Incidental calling, answering, testing or working (including casual conversation, remarks or messages) not pertinent to constructive handling of the emergency situation shall be prohibited within these bands.

(b) The Commission may designate certain amateur stations to assist in the promulgation of information relating to the declaration of a general state of communications emergency, to monitor the designated amateur emergency communications bands, and to warn non-complying stations observed to be operating in those bands. Such station, when so designated, may transmit for that purpose on any frequency or frequencies authorized to be used by that station, provided such transmissions do not interfere with essential emergency communications in progress; however, such transmissions shall preferably be made on authorized frequencies immediately adjacent to those segments of the amateur bands being cleared for the emergency. Individual transmissions for the purpose of advising other stations of the existence of the communications emergency shall refer to this section by number (§ 97.107) and shall specify, briefly and concisely, the date of the Commission's declaration, the area and nature of the emergency, and the amateur frequency bands or segments of such bands which constitute the amateur emergency communications bands at the time. The designated stations shall not enter into discussions with other stations beyond furnishing essential facts relative to the emergency, or acting as advisors to stations desiring to assist in the emergency, and the operators of such designated stations shall report fully to the Commission the identity of any stations failing to comply, after notice, with any of the pertinent provisions of this section.

(c) The special conditions imposed under the provisions of this section shall cease to apply only after the Commission, or its authorized representative, shall have declared such general state of communications emergency to be terminated: however, nothing in this paragraph shall be deemed to prevent the Commission from modifying the terms of its declaration from time to time as may be necessary during the period of a communications emergency, or from removing those conditions with respect to any amateur frequency band or segment of such band which no longer appears essential to the conduct of the emergency communications.

Operation of Additional Stations

§ 97.108 Operation of a remotely controlled station.

(a) An amateur radio station may be operated by remote control only from an authorized control point, and only where there is compliance with the following:

(1) The license for the remotely controlled station must list the authorized remote control point(s). A photocopy of the remotely controlled station license must be posted in a conspicuous place at the authorized control point(s), and at the remotely controlled transmitter location. A copy of the system network diagram on file with the Commission must be retained at each control point. The transmitting antenna, transmission line, or mast, as appropriate, associated with the remotely controlled transmitter must bear a durable tag marked with the station call sign, the name of the station licensee and other information so that the control operator can readily be contacted by Commission personnel.

(2) The control link equipment and the remotely controlled station must be accessible only to persons authorized by the licensee. Protection against both inadvertent and unauthorized deliberate emissions must be provided. In the event unauthorized emissions occur, the station operation must be suspended until such time as adequate protection is incorporated, or there is reasonable assurance that unauthorized emissions will not recur.

(3) A control operator designated by the licensee must be on duty at an authorized control point while the station is being remotely controlled. Immediately prior to, and during the periods the remotely controlled station is in operation, the frequencies used for emission by the remotely controlled transmitter must be continuously monitored by the control operator. The control operator must terminate transmission upon any deviation from the rules.

(4) Provisions must be incorporated to automatically limit transmission to a period of no more than 3 minutes in the event of malfunction in the control link.

(5) A remotely controlled station may not be operated at any location other than that specified on the license without prior approval of the Commission except in emergencies involving the immediate safety of life or protection of property.

(6) A repeater station may be operated by radio remote control only where the control link utilizes frequencies other than the repeater station receiving frequencies.

[§ 97.108 added new eff. 10-17-72; VI(72)-1]

§ 97.109 Operation of a control station.

(a) Amateur frequency bands above 220 MHz, excepting 435 to 438 MHz, may be used for emissions by a control station. Frequencies below 225 MHz used for control links must be monitored by the control operator immediately prior to, and during, periods of operation.

(b) Where a remotely controlled station has been authorized to be operated from one or more remote control stations, those remote control stations may be operated either mobile or portable.

[§ 97.109 added new eff. 10-17-72; VI(72)-1]

§ 97.110 Operation of an auxiliary link station.

(a) An auxiliary link station may use amateur frequency bands above 220 MHz excepting 435 to 438 MHz for emissions. Frequencies below 225 MHz used by an auxiliary link station shall be monitored by the control operator immediately prior to, and during, periods of operation.

(b) An auxiliary link station may only be used for fixed operation from the location specified on the station license, and only when its associated station(s) is operated from its authorized land location.

[§ 97.110 added new eff. 10-17-72; VI(72)-1]

§ 97.111 Operation of a repeater station.

(a) Emissions from a repeater station shall be discontinued within 5 seconds after cessation of radiocommunication by the user station. Provisions to automatically limit the access to a repeater station may be incorporated, but are not mandatory.

(b) The transmitting and receiving frequencies utilized by the repeater station shall be continuously monitored by the control operator immediately prior to, and during, periods of operation.

(c) A repeater station may be concurrently operated on more than one frequency band, provided the necessary showings have been approved by the Commission for each frequency band of operation. Crossband operation of repeater stations is prohibited, i.e. both input (receiving) and output (transmitting) frequencies for a particular repeated transmission must be within the same frequency band. Operation on more than one output frequency on a single frequency band is prohibited except when specifically approved by the Commission. Repeater stations authorized to operate in conjunction with one or more auxiliary link stations may utilize an input frequency in a different frequency band provided the input frequency of the auxiliary link station(s) is in the same frequency band as the output frequency of the repeater station.

(d) A repeater station shall be operated in a manner so as to assure that the station is not used for one-way radiocommunication other than provided for in § 97.91.

(e) A station licensed as a repeater station may only be operated as a repeater station, excepting for short periods for testing or for emergencies.

[§ 97.111 added new eff. 10-17-72; VI(72)-1]

(To be continued next month.)

NES

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W2NSD/1 cont. from page 102

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The whole IRS system is pernicious. Look what it does to judges—they are frightened too. No one is safe from an audit – and, as Milton Friedman pointed out recently in Playboy in an interview, no one is safe from being arrested and put in jail by the IRS on fraud, no matter how honest they are. Judges have to be extra careful with their careers if they want to move ahead—and what judge doesn't have an eye on the Supreme Court bench? A big black tax suit in his record could ruin him.

The system is no better on the IRS agents themselves, who are prisoners of a soul-destroying situation. They *have* to produce. When they audit they are expected to come up with money. And promotion is tied in with money produced, even though this is not the official policy of the IRS—this is the way it works. And an agent that loses a case loses his career and may end up as a bail bondsman in Fitchburg, Massachusetts. This results in desperate measures being brought against taxpayers and is the main reason why they stoop to phone taps and mail checking.

How far will they go? Well, our old records are not locked up with extreme care, and they have been gone over by the IRS agents several times. I recently went through what we had left to see what some of the checks might be that they had brought up as being personal expenses. Every single record that we had of cancelled checks, invoices, all such records were missing. Were they kept by IRS agents? Did someone sneak into our attic and steal those particular papers, leaving all other records such as subscription sales, book sales, payments for articles, adverttising sales, bulk sales, newsstand sales . . . etc? Weird.

This Gestapo-type branch of the legislative part of our government will operate in this way just as long as everyone is afraid of them and no one does anything to back them down. The revelations during the Watergate hearing of IRS use for political harassment brought this situation into the light for many taxpayers for the first time. The people who don't want to be bothered with this sort of mess are the ones that keep it going—and they are the ones who will get caught up and trampled eventually.

Now that the FBI has been backed off a bit – and the CIA is taking it easier – perhaps it is time to stop the really vile things that IRS is doing and get us a little more away from being a police state.

You can bet that I'll be taking notes on this case and let you know just what kind of police-state tactics are used against me. Frankly I don't see how the case can end up with anything but an apology from the IRS and perhaps even a prosecution of one or more of their agents for perjury.

Watch for more news.

SEPTEMBER REPEATER TEST

Are the new repeater rules being observed?

Repeater groups seem to agree that the new regulations not only are without the saving grace of reason, they are also extremely repressive. Now that all of the new regulations are in effect, how many repeater groups are abiding by them and how many are ignoring them – a la our more successful cousins on 27 MHz?

A test was made in mid-September to get a feel of how things are going. A team set up a test site on a high mountain and checked the number of repeaters on the various channels which were heard in a period of 10:00 to 10:30 PM, noting the number on each channel. Then, the next morning at 5:00 to 5:30 AM the same test was made. The results may be of interest. During the morning test a transmission was made four times on each channel asking if there was anyone on channel. No answers were received on any channel.

There were 30 repeaters clearly heard in the evening test. Twenty-five were there in the morning test. Fifteen of the twenty-five had identification. Only three of the five repeaters which had been turned off for the night had identification in the night test.

This would indicate that in this test 10% of the repeaters were operating according to the identification and monitoring rules. 83% were staying on the air and not being turned off at night. Ten had WR calls (30%).

So here we have about 90% of the active repeater groups openingly flaunting the regulations. This is historical, in a way. In the past repeater groups have always been in the forefront of legality — bending over backwards in most cases to make sure that everything was according to Hoyle. They haven't caught up with the CBers yet in their open disdain for rules, but it seems obvious that Walker has found a way to destroy the time-honored rapport between the FCC and the amateurs.

18803 RECONSIDERATION

In early August FCC Chairman Dean Burch called in response to the furor over the repeater regulations and suggested that a hearing be organized to familiarize the Commissioners with the scope of our problems and the proposed changes in the regulations that might set things right.

Chairman Burch agreed to have the seven Commissioners attend the hearing and I promised to have representatives of the major repeater councils present to present the case and answer any questions.

Mr. Burch further asked that a paper be provided the Commissioners a month before the hearing to familiarize them with the problems and suggested rule changes.

The above may come as quite a shock to the ARRL HQ staff who have been urging conciliation with Walker and who have been openly critical of my efforts to get through to a level that could help us get the changes we need. Hollaring does work now and then.

The hearing is scheduled for January 14th in Washington and I plan for those council representatives who are going to help with the hearing to be in Washington a day early so that the schedule for the presentation can be worked out carefully and areas of expertise be established for answering questions.

I have already been in contact with many of the major repeater councils and have asked each for a resume of the problems posed by 18803 — the proposed changes in the regulations — and the reasons for these changes.

If there are any councils that have not been contacted and who wish to field a representative for this critical hearing, please get in touch with me. There are several requirements, and they are important. A rep must be very familiar with both repeaters and the regulations — he must be well spoken and not given to any unnecessary talking — he must be able to think fast and not get sidetracked by personal questions or problems of his repeater — his group must furnish me with a resume of problems and proposed changes by November 15th — and he must appear in Washington at his or the council's expense for the hearing. I hope that sounds reasonable.

In my past talks with FCC officials I have found that a great deal of their time has been wasted by excursions into individual problems — and listening to amateurs who have a serious need to talk, but who listen very little. It is unfortunate that there are quite a few repeater owners who suffer from this problem. One in Connecticut comes to mind immediately — a chap who is a laughing stock at the Commission because his problem is so serious.

This is our chance to get the word right to the top — and, as far as I know, this is the first time anything like this has ever happened. I suspect that the July 9th session with the ARRL may have helped to open the ear to our troubles.

By the way, the hearing is for the purpose of discussing regulations already enacted, not any under consideration, so we'll have to soft pedal our screams of anguish on the 224 MHz CB proposal and stick to the repeater rules. There's plenty there to keep us busy.

FCC ACCUSED!

The Bureau of National Affairs, an organization which supplies legal and financial data to businessmen, recently charged that the FCC has become a haven for attorneys who are failures at the bar. The BNA pointed out that about 25% of the lawyers hired last year by the FCC failed the bar exams they were required to take.

No wonder the amateur regulations have gotten so screwed up in the last year! (Thanks WN5GUN)

NEWSWEEK ATTACKS TOO

The September 10th issue of Newsweek (page 53) put CB in fair perspective and this publicity should help to slow down the FCC's anxious drive to please the EIA at all costs. The false cry for help in New Mexico made headlines all over the country and helped to blacken the eye of CB — two hundred rescurers and 22 planes involved in the search — hoax. (Thanks W9BOZ)

WRITING CONGRESS SIMPLIFIED

Rather than have to sit down and work out a long and complicated letter to your congressman explaining what the problems are and what you would like him to do about it — a writing chore that manages to knock out about 99.99% of the letters that might otherwise get to congress — 73 has prepared a short newsletter (two sheets) which outlines the whole situation.

This newsletter is available for free from 73 Magazine — send a self-addressed stamped envelope (business size).

The newsletter discusses the purposes of amateur radio and how we are meeting those purposes with great success. It goes into the main areas of communications that amateurs have pioneered — and this is just about every major communications technique in use today. It explains why amateurs need help now, outlining some of the devasting regulations Walker has laid on us.

There is a brief explanation of why all of the major developments in communications have been made by amateurs — and also an explanation of what repeaters are and how they work. Just in case your congressman is not sure of the difference between CB and hams, this is also covered.

The ending of the paper tells your congressman how he can help us — and you.

Remember — it is extremely important to write to your congressman and to your senators — and it won't hurt to send along a copy of this letter we have made for you.

Why haven't we just bulk mailed the letter to congress? Because it takes your personal covering letter to get it past the round file in the mail room. We've worked hard to make this for you — will you help by seeing that it gets where it should?

When writing that covering letter, address it as follows — for,

Representatives:

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House of Representatives
Washington DC 20515

Dear Mr.

and for Senators:

The Honorable
United States Senate
Washington DC 20510

Dear Senator

The address for the newsletters is 73 Magazine, Peterborough NH 03458, and don't forget the SASE.

FCC MEN GRIPE!

A little note in the Federal Times said that career civil servants in the FCC have been griping at the large number of ex-military men who have been brought in by an ex-Air Force officer. One division of the Commission has been called a "little Pentagon." (Thanks WB5BKM)

. . . WAYNE

Cont. from page 98

common purpose because we have allowed ourselves to become divided. And unless this senseless division is healed and until the fraternity has been reunited in vigorous pursuit of it's objectives, we will remain ineffective and powerless to stand up and fight for our priviledges which are in certain jeopardy.

The FCC is empowered to regulate the communication art by the Act of Congress of 1934, as amended. And I suggest that every concerned amateur look into this document which can be found in many public libraries and is available for a nominal charge from the United States government printing office. See what it is that the FCC is empowered to do and determine for yourself whether or not the amateur and citizen's radio service division is living up to those responsabilities with which it is charged. If you find, as I have, that there are questions to be answered and satisfaction required, then sit down and write your elected representatives, your senators, your congressmen, noted hams who are in the public eye. . .and there are many of them. Forget about which faction you belong to, or which magazine you subscribe to, or which publisher's views you adhere to, or what you feel about this or that league. Remember that you are a member of a unique fraternity of communicators and technicians and that the really important thing right now is the survival of the fraternity under honest and realistic regulation. Don't ask for anarchy. . . ask for common sense application of logic in rulemaking.

If enough of us can see the real and hidden dangers in the present situation, there may be hope yet and time yet. But, if we wait for the other guy to do the job, we will all be lost.

Norman Joseph Sternberg
W2JUP/WB2ZWR
Levittown NY

AMEN!

HAM SOLITUDE

Just finished renewing my subscription to "73" for two more years.

Since I'm the only amateur radio operator in Big Stone City, S. Dak., I'm glad to have a friend like "73" to keep me up to date on the latest goings-on in the amateur radio world. Keep up the good work.

David L. Martin, Sr. WB0CIY

WANT A GUEST?

I wonder if there are amateurs in England, Europe, and Scandinavia who would enjoy a visit from a travelling American ham. I'm planning on making a trip to these areas next summer and as I found out last summer, a trip can be made much more enjoyable by having contacts with foreign hams.

Jon Forrest WB6EDM
21414 De La Osa St.
Woodland Hills CA 91364

ATTENTION ADVERTISERS

I quit the League in 1963, also the firms that cut you off their advertising budgets. How stupid they were, they cut off the wrong outfit and made a helluvamess.

I noted that one of the firms which I stopped patronizing in '63 began to advertise in 73 in February of this year. I read the ad, and on my way to Portland stopped off to see a friend in Albany where I looked at the new FPM300 Hallicrafter transceiver, tried it out – then didn't go to Portland! Came directly home with a new 300. If I hadn't seen their ad in 73, I wouldn't have even looked at it, as I was going to Portland to buy another make. Chalk up one for 73. When I registered the new 300, I said I saw the ad in 73 and hadn't bought any Hallicrafter equipment since 1963. There wasn't much room on the registration card, but I was able to imply that the big outfits should have gotten into the fight to save ham radio.

Keep slugging, Wayne.

Paul J. Rasmussen K7EML
Sutherlin OR

LOBBY

I agree with you that ham radio needs more political support in Washington. Probably a lobby is the answer, and I would be willing to contribute money to support one.

Ivan T. Schultz, M.D. W0FDM
Benedict MN

SUCCESS STORY

I would like to compliment you on your fine magazine – especially the great construction articles. I have recently finished a homebrew project using IC's and printed circuit board. I don't remember what it is supposed to be as I misplaced the issue of 73 I built it from.

As most people do, I made several slight changes in the design. I eliminated the power supply as my house has 110 volt outlets all over and I could conveniently plug this little gem in wherever I wished – even in my ham shack. The black areas are soot from the smoke that poured forth when I first *fired* it up. I thought this was going to be a recurring problem but it hasn't happened since.

Hope to see more of the same solid state construction articles and also high power transmitter and amplifier projects. I really want to get my hands into something that uses 5 kV or so.

By the way, does it really save money in the long run to get a life membership to 73 Mag?

Jack R. Main W4YCZ
Norfolk VA

If you start applying 5 kV to your IC projects it will certainly save US money!

(More New Products)

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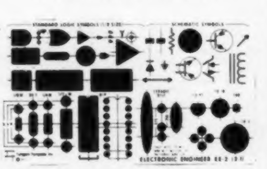

The *Electronic Engineer* template series incorporates on each template the most useful logic, schematic and component layout patterns necessary for the majority of electronic circuit design requirements. Each template features a complete set of usable schematic and logic diagrams. Also included are the basic component layout patterns required for laying out scaled printed circuit board designs. Featured are basic resistors, capacitors and semiconductors used in most electronic equipment.

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☐	146.31–91	☐
☐	146.34–94	☐
☐	146.37–97	☐
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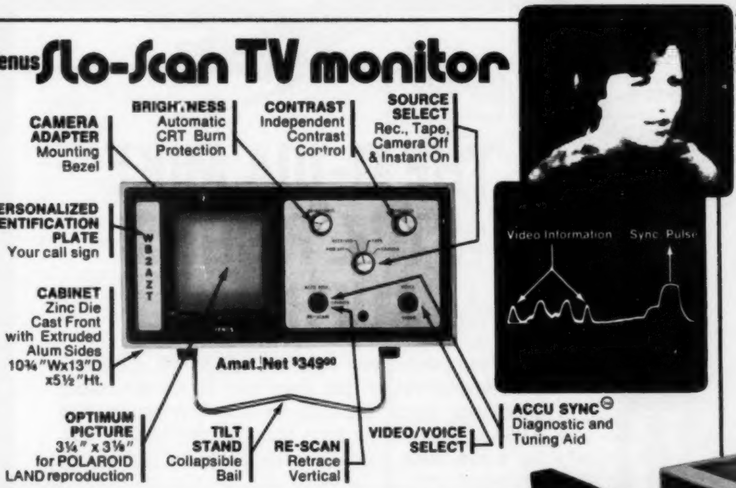
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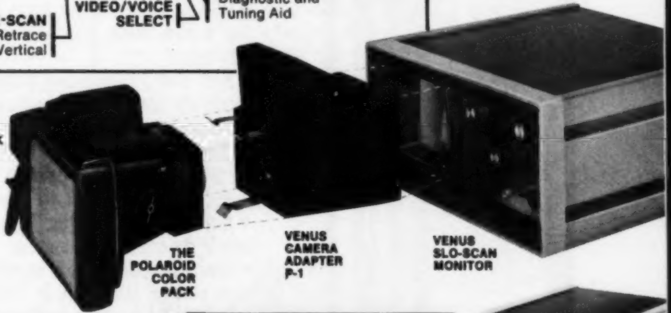
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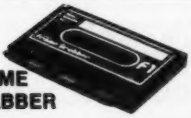
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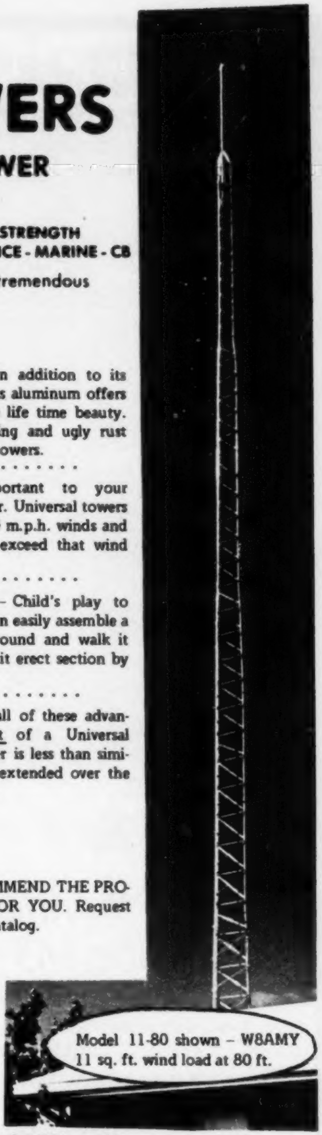

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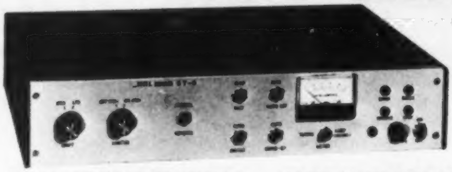

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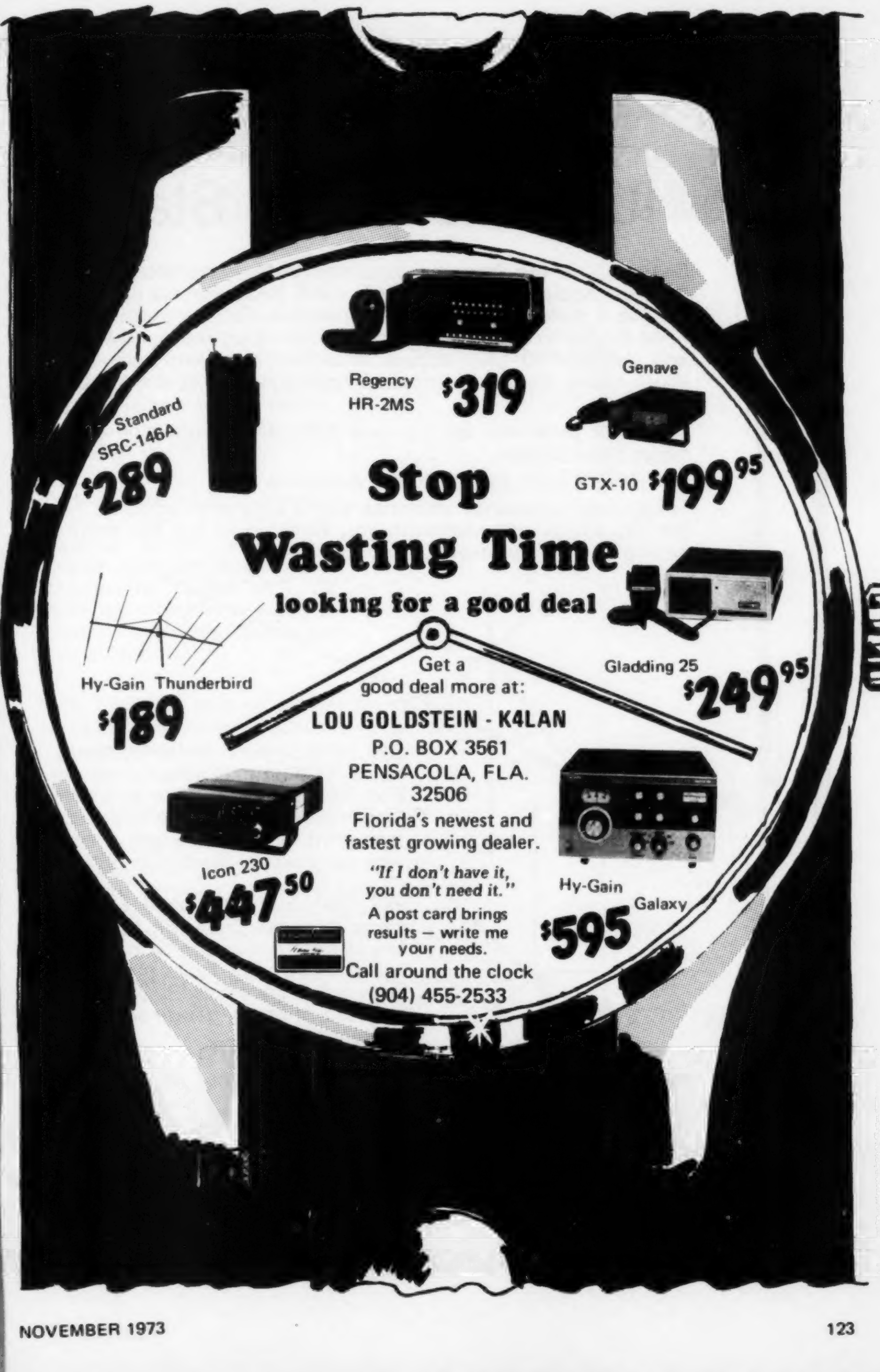
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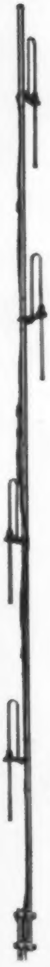

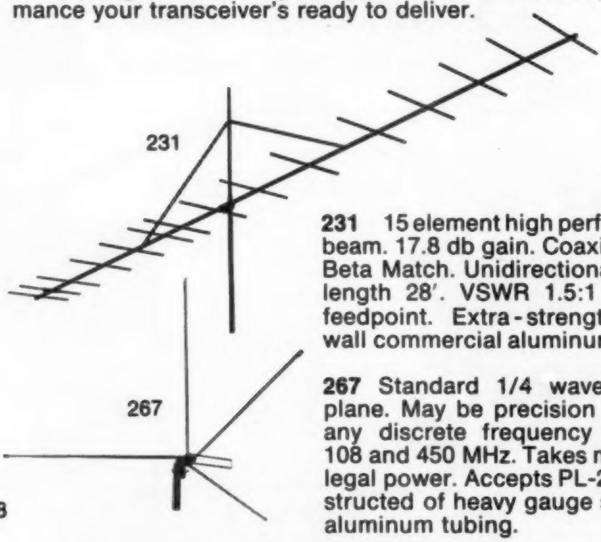

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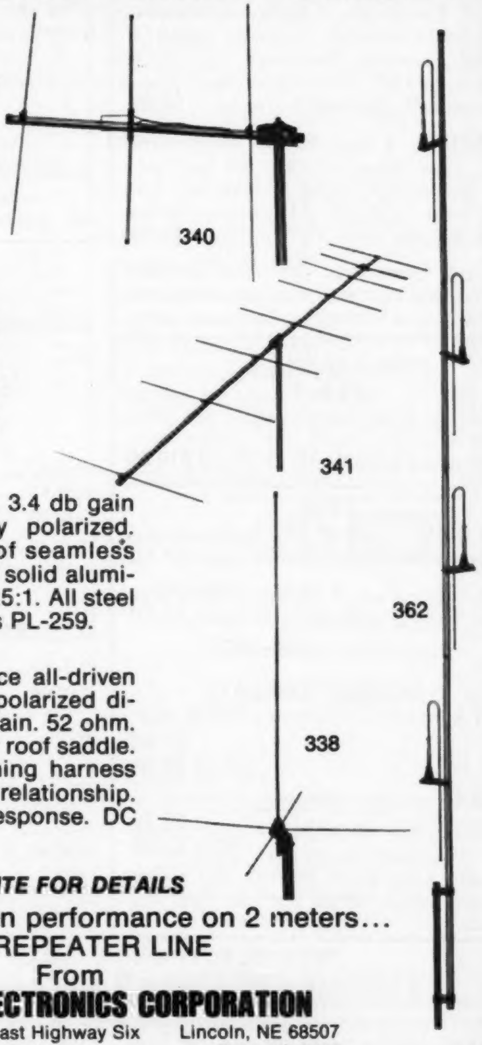

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	min	max	min	max	
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Notes:
NJF10 is usable to 450 MHz;
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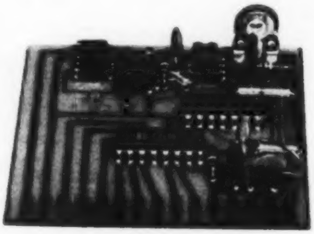

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Outputs are ANDed TTL logic highs.
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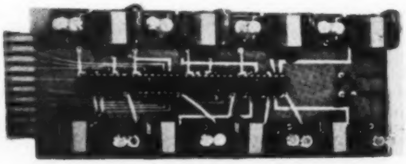

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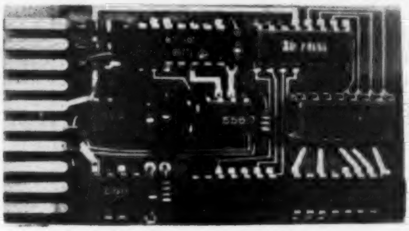

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For 5 minute timer and tone oscillator add $5.00 to Kit price and $6.00 to Tested Unit price.

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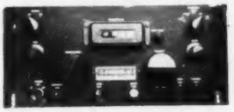
Can be best described as a mini version of the R390A rec, and has most of the key features of the 390A.



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5" to 7¼" – 16 slides and sockets includes 30 double contact position edge connector type
Price: $9.95 ea.

Receiver type VHF-2RM 108-135 MHz crystal control Double Conversion AM with AVC noise limiter and squelch-tunable. 115 volts, 50-60 cycles. Price: $24.95.

WINTRONIX MODEL 850 INDUCED WAVE FORM ANALYZER. This unit, in conjunction with your present oscilloscope, permits you to view wave forms in the range from audio thru MHz without any direct connection. The probe is simply placed over the tube in question and the wave form is displayed on the oscilloscope. It may also be used as a high gain amplifier to increase scope sensitivity. Excellent for TV, radio, amplifier, and transmitter repair and maintenance. Brand new, with probe.
SHIP WT. 13 lbs. **Price: $19.95 ea.**

MODULE TYPE POWER SUPPLY TRANSISTOR, REGULATED.

115V – 60 cycle in +12 –12 –6V @ 3 amp output. Front Panel adj + or –10%. On-off switch. Fuses. Barrier strip output. 6" x 5" x 7". Excellent Cond.
Ship. Wt. 10# Price: $14.95 ea.

DIGITAL READOUT SET

Make your own counter, frequency meter, digital voltmeter, readouts, etc.
Kit includes
6 nixies with 6 sockets
1 transformer
1 P/S board w/socket

PRICE: . . . .$12.95, 2/$20.00

B-7971 LARGE ALPHA NUMERIC READOUT

With sockets & driver board. Can be hardwired to form unusual house address numbers. 2 tubes, 2 sockets, mounted on one driver board. Save $3.00
Price: 5/$5.00

COMPUTER TYPE CAPACITORS

40,000 @ 20V
32,500 @ 25V
55,000 @ 15V
100,000 @ 8V
50¢ each or 5 for $2.00

40,000 @ 10V
30,000 @ 10V
PRICE: 3 for $1.00

Receiver R-36/GR 225-400 MHz. Crystal Control Double conversion FM with squelch and noise limiter. 600 ohms output. 115-230 Volts, 50-60 cps. Price: $24.95

Coaxial relays, single pole - double throw, available in UHF,BNC, Type N. Specify.
Price:$4.95 each.

Quality precision polished plate glass 2.200" by 9.540" by .250".
Price: 4 pc/$1.00, 25 pc/$5.00

We have a few receivers with AC power supply installed.
Price: $199.50

Adapters BNC to SO-239. Price: 2/$1.00.

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ONE OF A KIND

Sorenson Power Supplies:

MA 28 30, 28 V, 30 A	Price: $125.00
ERA 0–36 V, 50 A	Price: $150.00
ERA 0–36 V, 20 A	Price: $100.00

Transmitter, 110 W FM, 406–420 Mc. Rack mount, with power supply.
Price: $150.00

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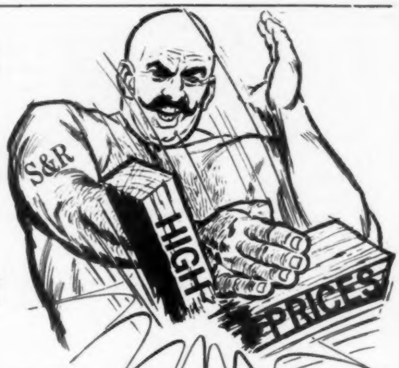

This Month's Specials

S&R makes economy exciting!

Motorola RF Transistors Unmarked

Type	Qty.	Price
2N3866	1352	3/1.50
2N5589	364	3/6.00
2N5590	112	3/9.50
2N5591	44	3/20.00
2N6080	222	3/6.00
2N6081	280	3/9.50
2N6082	173	3/16.00
2N6083	173	3/24.00
2N6084	260	3/30.00
2N6166	50	3/50.00
MRF304	17	3/30.00

Motorola RF Transistors Marked

2N1692	3	2.00
2N1693	3	3.00
2N2857	1	1.00
2N2887	2	3.00
2N2947	9	8.00
2N3925	394	2.00
2N3950	13	10.00
2N4072	1963	.75
2N4073	2	1.00
2N5109	1361	1.25
2N5177	1	6.00
2N5179	1744	.35
2N5583	1	3.00
2N5590	30	5.00
2N5591	4	9.00
2N5643	14	10.00
2N5849	4	15.00
2N5862	11	20.00
2N5942	14	20.00
2N6081	20	6.50
2N6082	24	10.00
2N6083	25	15.00
2N6084	384	2/30.00
2N6097	21	15.00
2N6135	1	5.00
2N6166	40	30.00
2N6266	2	40.00
MM1500	2	2.00
2N5842	950	2.00
MM1620	2	10.00
MM1661	1	5.00
2N5645	1	5.00
MM8006	1000	1.00
MRF207	1	3.00
MRF209	4	8.00

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Motorola HEP Semiconductors

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specials

RF Transistors	Price Each	Our Price
HEP 75	$ 2.95	2.00
HEP 76	4.95	4.00
S3001	3.75	3.00
S3002	8.20	6.50
S3003	20.00	15.00
S3005	9.55	7.00
S3006	19.90	15.00
S3007	24.95	19.00
S3008	2.18	1.60
S3010	4.90	3.00
Hot Carrier Diodes		
HEPR0700	1.09	1.00
V.C.C.		
HEPR2500	1.10	.88
R2501	1.10	.88
R2502	1.10	.88
R2503	1.10	.88
R2504	1.10	.88
R2505	1.10	.88
FETs		
HEP801	1.59	1.20
803	3.39	3.00
F0021	1.89	1.50
F1035	1.29	1.00
F2004	2.50	2.00
F2005	2.90	2.00
F2007	2.90	2.00

(Also HEP Cross Reference Available with Any HEP Ordered)

Bargains

Microwave Ass. A Components, Equipment Sale

Type and Manufacture	Qty	Price
FXR S155A	1	10.00
H. P. S370B	1	10.00
H. P. 360A	1	10.00
Airborne Inst. Inc. 7010	1	15.00
Narda 730S	4	5.00
Narda 730	1	5.00
Waveline 611	1	5.00
PRD 154	1	5.00
M.C.S. P-265-1	2	7.00
PRD 559A	1	15.00
Narda 211	1	25.00
Waveline 658	1	5.00
H. P. HX292B	1	4.00
Narda 614	1	6.00
Narda 615	2	10.00
Omni Spectra 201845/J	8	5.00
Demornay Bonardi L-450	2	7.00
Narda 350H	2	3.00
Waveline 641	1	3.00
Waveline 642	1	4.00
Demornay Bonardi HJ-018	1	6.00
Guide Ind. Inc. 1515-.5	2	4.00
Aircom 106C00	1	7.00
Unilinern 125	1	5.00
Airborne Inst. Lab. 70B-49	1	15.00
Frequency Eng. WG-1217-5B	1	20.00
Frequency Eng. 5882-4N	1	20.00
Frequency Eng. 8397-1	1	10.00
H. P. X421A	1	10.00
H. P. G487A	1	15.00
H. P. X281A	1	5.00
H. P. 420B	2	10.00
H. P. 775D	1	50.00
PRD X1410	1	5.00
FXR X601A	1	6.00
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Rantec MX-200	2	4.00
Waveline 554	4	4.00
Narda 301	1	10.00
FXR X1551	1	6.00
PRD 188A	2	10.00
FXR X410B	1	10.00
Narda 1011	1	10.00
H. P. H750D	1	10.00
Varian VA1281B	1	7.00
Gombos G-450	6	5.00
Demornay Bonardi H480	13	5.00
Demornay Bonardi J480	1	5.00
Demornay Bonardi J102	2	5.00
Demornay Bonardi XL-102	1	5.00
PRD 585B	1	10.00
PRD 130A	1	7.00
Demornay Bonardi L-234	1	10.00
Demornay Bonardi DBL-650	1	10.00
Demornay Bonardi L-610	1	10.00
Demornay Bonardi DBL-440A	1	10.00
Waveline 260	1	15.00
Demornay Bonardi L-010	1	10.00
L. H. Terpening Co. 3232-550	1	10.00
Guide Ind. Inc. 1516-.5	2	10.00
H. P. 430C	2	20.00
H. P. 430B	1	15.00
Narda 438	1	20.00

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Microwave Semiconductors Corp.

	Price
MSC2001	35.00
MSC3001	60.00
MSC4001	87.00
MSC4003	125.00

Communications Corp.

D1-28	3.75
D10-28	19.00
E1-28	30.00

Dickson Fast Recovery Diodes

1N3891	2.00
1N3890	2.00
1N3880	2.00

YOU NAME IT . . .

Tubes WE'VE GOT IT!

NEW	Price Each
6146A	$ 4.00
8683	15.00
8106	2.00
8102	1.30
7984	3.95
6907	15.00
6360	5.00
8298	3.50
6146B/8298	4.50
5894A	17.00
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5894	8.00
2E26	1.25
6939	3.00
6883	2.00
6360	2.50
8032	2.00
8106	1.00
8458	5.00
6907	7.50
7377	7.50
8683	7.50
5762/7C24	100.00

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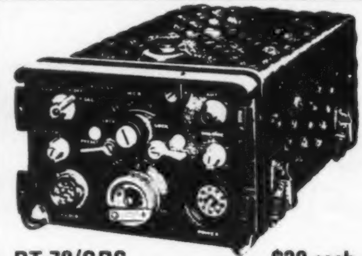
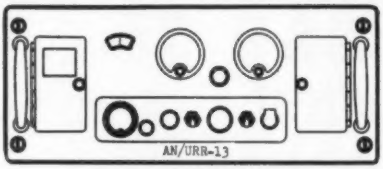


RT-70/GRC **$20 each, 3/$50**

Latest government release. Transmitter-Receiver RT-70/GRC covers 47 to 58.4 mc FM. Requires only 90 Volts dc and 6 volts dc. Used, visually OK, supplied with schematic.

1 MC crystal used for calibration $4.00

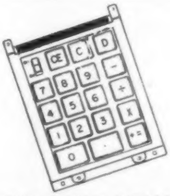
116 page maintenance manual for GRC$2.00



URR–13 RECEIVER

Listen in to jet planes, Air Force 1, U-2 spy planes, FBI, etc. They use the frequency covered by this receiver . . . 220 to 400 mc. Possibilities of covering the 220-450 mc band by re-tuning. Operates from regular 115 Volt 60 cycle, requires only antenna and speaker. Tuneable through the frequency, direct reading dial. Schematic and write up on this set furnished.

Visually OK condition . . . URR-13 - $50.00

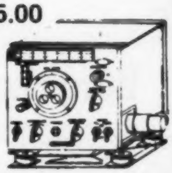


CALCULATOR KEYBOARD

A nice purchase by us due to contract termination. Brand new, 2 styles available, one for use with Gen. Inst. C-500 chip, another for use with Cal-Tex 5001 and 5002 chips or Mostek 5010 and 5012 chips. Measure approx. 2.6 x 3.7 inches.

Calculator Keyboard - $8.00 (either one), any 2 for $15.00

LM FREQ METER $35.00



Lowest price yet. W/tubes, crystal and original calibration book. Look OK but unchecked. Typical schematic furnished.
8 lbs. ....#LM 35.00

TCS RCVR or XMTR

Used, look good, with schematic, receiver or transmitter. Frequency range 1.5 to 12 MC. Three bands, VFO or crystal, voice and CW. These sets Collins design, becoming scarce.

RCVR or XMTR $35.00

RCA INJECTION LASER DIODES

Another SUPER SCOOP by Meshna. Brand new RCA packaged, considered obsolete by RCA but what an exotic opto-electronic device for the sophisticated experimenter. Only several hundred on hand. Values shown are approx. as each diode characteristic varies. Each is marked with correct value.

6 WATT $10.00

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RCA TD-XI TUNNEL DIODE

Original packaged, each factory marked, with spec sheet.

$1.25 each, 5/$5.00.

15 AMP BATTERY CHARGER

Brand new GE transformer, 25 amp fullwave bridge. Output approximately 15 volts up to 15 amps. Ideal battery charger or DC source for general use. With instructions , assembled in minutes.

PK–4 **$7.50**

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COMPUTER KEYBOARDS

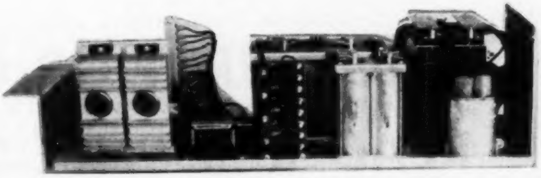
BRAND NEW

$50 postpaid

Just arrived, a superb batch of brand new keyboards still in original manufacturers cartons. Beautifully finished in pastel colors with contrasting colored keytops. Made for table operation with fully enclosed metal cabinet. Two encoder boards mounted inside the cabinet with connections terminating on Spectra flat cable with plug. Key operation with bounceless magnet reed switch action. These computer keyboards were dumped as surplus by one of America's largest electronic companies and we were lucky enough to be on the receiving end. The price of $50 includes prepaid insured shipment in the US and shipment same day as order received. Orders out of the US require an extra $2.00.

LOGIC POWER SUPPLY

$10



With 400 of these power supplies on hand, we figure we'd better sell them cheap and get them off the floor or all will collapse with a great crashing roar and land in a heap in the cellar.

These are from computer power supplies, used, good condition. Operate from standard house current. 4 output voltages .... MINUS 30 Vdc at 1 Amp, PLUS 30 Vdc at ½ Amp, PLUS 10 Vdc at 1 Amp, MINUS 10 Vdc at ½ Amp. Solid state construction with harmonic regulation on the transformer and transistor regulation on the 10 volt outputs. This is one helluva bargain and worth buying just to scrap for parts (if you're crazy enough to tear it apart). You've got 2 transistorized zener regulated plug-in boards with sockets and by changing the zener you can regulate from zero to 25 volts, 2 husky filter caps (18,000 μf at 35 volts), power transistors on heat sinks, a nice transformer, and misc. other parts.

Ship. wgt. 37 lbs (you pay shipping) **$10.00 each or 3/$25.00**

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

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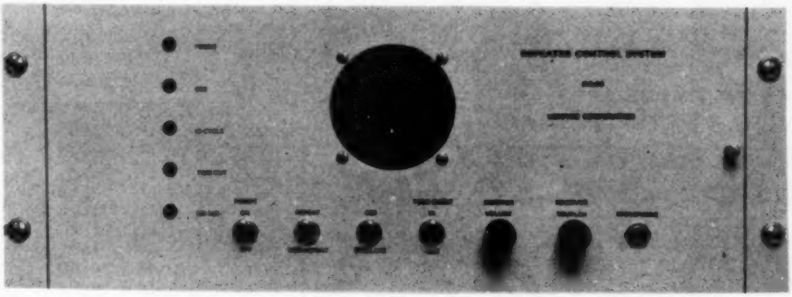

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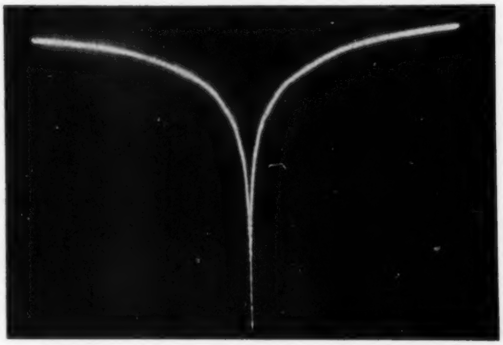

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7400	.25	7432	.30	7473	.55	74145	1.25
7401	.25	7437	.50	7474	.55	74151	1.05
7402	.25	7440	.25	7475	.95	74153	1.45
7403	.25	7441	1.25	7476	.55	74154	1.75
7404	.29	7442	1.15	7483	1.25	74155	1.35
7405	.27	7443	1.25	7485	1.20	74157	1.50
7406	.55	7444	1.30	7486	.55	74161	1.65
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7409	.29	7446	1.45	7490	1.25	74165	2.95
7410	.25	7447	1.45	7492	1.05	74175	2.95
7411	.35	7448	1.50	7493	1.05	74181	4.50
7413	.95	7450	.29	7494	1.10	74192	1.65
7420	.25	7451	.32	7495	1.05	74193	1.65
7423	.37	7453	.32	7496	1.05	74194	1.65
7425	.39	7460	.30	74121	.55	75195	1.15

FIRST TIME OFFERED

9601 Retriggerable one shot $1.15 ea

8000 Series	
8091	.69
8092	.69
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8123	1.75
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8520	1.45
8551	1.95
8810	.95
8812	1.25
8831	1.95
8836	1.25

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7453 ... 7/$1.00	LM308 ... $.95 ea	LM747 ... $.75 ea
7454 ... 7/$1.00	LM723 ..... .50 ea	8836 ...... .40 ea
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SALE PRICES END NOVEMBER 30

Low Power Devices			
74L00	.40	74L72	.60
74L02	.40	74L73	.80
74L04	.40	74L74	.80
74L10	.40	74L78	.80
74L16	.40	74L85	1.25
74L20	.40	74L86	.95
74L30	.40	74L90	1.75
74L42	.80	74L93	1.75
74L51	.40	74L95	1.75
74L71	.60	74L164	2.95

Linears	
LM300 Pos V reg (super 723 V)TO5	$ .95 ea
LM301 Hi performance ampl TO5	.45 ea
LM302 Voltage follower TO5	.95 ea
LM304 Neg Volt regulator TO5	1.25 ea
LM305 Pos Volt regulator TO5	1.25 ea
LM307 Op Amp (super 741) TO5	.45 ea
LM308 Micro power Op Amp TO5	1.25 ea
LM309K 5V 1A power supply reg TO3	1.95 ea
LM309H 5V regulator TO5	1.25 ea
LM310 Volt follower Op Amp TO5	1.45 ea
LM311 Hi perf volt comp TO5	1.25 ea
LM320 -5.2V Neg regulator TO3	1.95 ea
LM320 -12V Neg regulator TO3	1.95 ea
LM320 -15V Neg regulator TO3	1.95 ea
LM380 2 watt audio amplifier Dip	1.75 ea
LM3900 Quad Amplifier Dip	.50 ea
LM709 Op Amp TO5 or Dip	.29 ea
LM723 Volt reg. Dip	.75 ea
LM741 Comp Op Amp TO5-Dip 10/$3.95	.45 ea
LM747 Dual 741 Op Amp Dip 4/$3.50	.95 ea

Phase Locked Loops	
NE565 Phase locked loop dip	$2.95 ea
NE566 Function Gen TO5-mini dip	2.95 ea
NE567 PLL/Tone Gen TO5-mini dip	2.95 ea

Memories – Are Made Of –	
1101 256 Bit Ram Mos (2501)	2.95 ea
1103 1024 Bit Ram Mos	7.95 ea
7489 64 Bit Ram TTL	3.25 ea
8223 Programable Rom Data Included with Memories	6.95 ea

LED	
MV108 Visible red SUPER SPECIAL	.25 ea
MV50 type red emitting	.25 ea or 5/1.00
MV5020 type Large red	.35 ea or 3/1.00
ME4 Infra red TO18	.69 ea
MAN 1 The Original	4.25 ea
MAN 3 type	1.95 ea, 3 or more 1.49 ea
MAN 4 type	2.75 ea, 3 or more 2.50 ea
Data Lite 707 (MAN 1 repl)	4.25 ea

Opto Isolators	
MCA 2 30 Darlington	.95 ea
MCD 2 Diodes	1.95 ea
MCT 2 Transistor	1.45 ea

MOS Shift Registers – *Limited quantities*	
2506 Dual 100 bit dyn. shift reg. (mini)	.30 ea
2509 Tristate dual 50 bit st. shift reg.	.30 ea
2510 Tristate dual 100 bit st. shift reg.	.30 ea
2511 Tristate dual 200 bit st. shift reg.	.30 ea
2518 Hex 32 bit static shift reg.	.30 ea
2519 Hex 40 bit static shift 2519 Hex 40 bit static shift reg.	.30 ea
2521 Dual 128 bit shift reg. (mini)	.30 ea
2522 Dual 132 bit shift reg. (mini)	.30 ea
2524 512 bit recirc. dyn. shift reg. (mini)	.30 ea
2525 1024 bit recirc. dyn. shift reg. (mini)	.30 ea
2527 Dual 256 bit static shift reg. (mini)	.30 ea
Assortment of any 2500 MOS items	4/1.00

NOTE: 2500 series MOS shift registers are factory seconds & have not been re-screened.

Calculator Chips	
5001 LSI (40 pin) Add, subtract, multiply & divide 12 digit	
Data supplied with chip	6.95 ea
Data only-Refundable w/purchase	1.00 ea
5002 LSI Similar to 5001 except designed for battery power	
Data supplied with chip	8.95 ea
Data only-Refundable w/purchase	1.00 ea
5005 LSI (28 pin) Full four function memory, 12 digit display and calc.7 segment multiplexed output	
Data supplied with chip	10.95 ea
Data only-Refundable w/purchase	1.00 ea

Digital Clock . . . on a Chip	
MM5311 (28 pin) Any readout. 6 digit BCD, with spec sheet	11.95 ea
MM5312 (24 pin) Any readout. 4 digit 1pps BCD, with spec sheet	8.95 ea
MM5314 (24 pin)LED-Incandescent readout 6 digit with spec sheet	10.95 ea
MM5316 (40 pin) Normal alarm, snooze alarm, sleep timer 12 or 24 hour operation, with spec sheet	15.95 ea

Grab Bag Specials	
15 Assorted DTLs (dip)	1.00/bag
15 Assorted TTLs (dips)	1.00/bag

NOTE: Factory seconds, not tested.

Satisfaction guaranteed. All items except as noted are fully tested. Minimum order $5.00 prepaid in US and Canada. California residents add sales tax. Orders filled within 3 days after receipt. Please add $.50 per spec sheet for items priced at less than $1.00 each.

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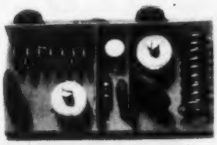
EXCITING NEW PRODUCTS



2-METER PREAMP

20 dB Gain, 2.5 N.F., 12V dc, Size 1" x 1¾" x ½". Diode protected MOSFET. 90-day guarantee. Sh. wt. 4 oz. Major Components Separately Shielded.

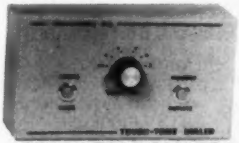
Kit $9.50
Wired $12.50

DATA ENGINEERING INC.
TONE ENCODER

TONE ENCODER

Eight pre-adjusted tones. Duration and Output adjustable, PLL circuitry for extreme stability. Choice of continuous or tone burst operation. Tone burst operation requires no batteries. Easy to install. Includes three special single or dual tones.

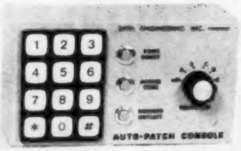
TE8-K Kit $31.95
Wired $39.95



TOUCH-TONE DIALER

The electronic touch-tone dialer for home and car. It's safer and more accurate to use than a pad. Memory includes Access Code plus five phone numbers. Numbers easily updated. Built-in monitor. Complete PTT operation with transmitter hold.

TTD-4K
. . . . WIRED . $59.00
Kit $49.00



AUTO-PATCH CONSOLE

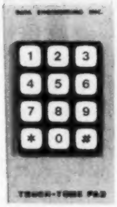
This mobile or home console includes all the features you need for complete auto-patch operation. A Touch-Tone Pad; an automatic dialer for sending one access code plus five Touch-Tone phone numbers; a single/dual tone burst encoder adjusted to your choice of frequency above 500 Hz, and a built-in motor. Complete PTT operation with one second transmitter hold.

APC-4K Kit $84.50
APC-4A Wired $98.50

TOUCH-TONE DECODER

A highly reliable twelve digit decoder with input protection, and PLL circuitry for extremely stable operation. Heavy duty output relays, small size, plug-in circuit board. All these major features at an UNBEATABLE price.

TTD-12K Kit $89.50
TTD-12 Wired . . . $129.50



TOUCH-TONE PAD

In less than 15 minutes you can convert your portable transceiver to Touch-Tone operation.

TTP Assembled . . . $44.50
TTP Kit $34.50

PAD-PULSER

Now you can also obtain pulsed operation from your Touch Tone Pad. Convert Touch-Tone frequencies to decimal pulses at 2805 Hertz with just a flip of the switch. Option can be added to TTP-2/K, TTD-4/K and APC-4/K.

PP-12K Kit $22.95
PP-12 Wired $29.95

DATA ENGINEERING INC.
FM FREQUENCY STANDARD

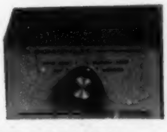
VHF FREQUENCY STANDARD – FMS-5

Cal. receive and transmit crystals in 10, 6, 2 and 1¼ meter FM bands. Markers for all FM channels. Check deviation. Precision 12 MHz crystal. No unwanted markers. Osc. and output buffered. Sh. wt. 2 lbs. (Less Batteries) . . $44.50
Kit $37.50

REPEATER ID

Highly stable oscillator for automatic timing. AC or DC operation. ROM provides for more than 25 characters, more than necessary for DC "any call" RPT. AUX is automatically added to ID if desired when main power is lost. Toneburst operation available.

ID-101K Kit $49.95
ID-101 Wired/Tested
$69.95
ID-101R assembled in 1½" rack cabinet $109.00



TONE DECODER

Versatile single/dual tone decoder. PLL circuitry for extreme stability. 1 amp output relay can be reset automatically or manually. Monitor position. Adjustable sensitivity. Internal strap selects single or dual tone operation.

TD-2K Kit $31.95
TD-2 Wired $39.95

5—year guarantees. Send for Catalog

BANKAMERICARD
master charge

Data Engineering, Inc. 5554 Port Royal Road
Ravensworth Industrial Park, Springfield VA 22151
Phone: 703-321-7171

VIDEO TAPE RECORDERS

BELL & HOWELL MODEL 2965

This is a portable system and comes with recorder, camera and charger. A TV monitor is built into the recorder. Camera includes built-in Microphone and Zoom lens. Recording time is 20 minutes on 5" tape. Recording is both video and audio.

SPECIFICATIONS

RECORDER:

AGC: Audio & Video
RESOLUTION: 525 lines, HOR. RESOLUTION: 300 lines
AUDIO RESPONSE: 80-10,000 Hz.
POWER REQUIREMENTS: 12V DC, 10 watts
BATTERIES: 2/3G x 3/U Rechargeable (not included)
CHARGER: Model 105905 included
GENERATOR: Built-in 2:1 EIA Sync Generator

CAMERA:

RESOLUTION: 525 lines
VERT. FREQ: 60 Hz (EIA)
HOR. FREQ: 15,750 Hz (EIA)
VIDEO OUTPUT: 1.0 p-p, 75 ohm, unbalanced
MIN. ILLUMINATION: 30 lux.
VIEWFINDER: 1½" (1" CRT w/magnifier)
LENS: 5:1 zoom F2 – 22
SHIPPING WT. 35 lbs.

LIST: $1595

OUR PRICE (NEW) **$550.00**

BELL & HOWELL Model 2966 – SHIBADEN SV700VC

(Assemble, Edit and Stop Motion)

This video recorder will record directly from a standard TV set or a TV camera. It will play back over your home TV set. Audio may be dubbed onto the tape. A 7" reel (2400') will record 1 hr. No home VTR unit under $1000 can match the quality and capabilities of this unit.

SPECIFICATIONS

RESOLUTION: 525 lines, Standard TV or CCTV recording
VIDEO: Input and output: 1.0V p-p, 75 ohms, unbalanced. Greater than 3.5 MHz freq. response. 300 lines plus Hor. resolution.
AUDIO: Mike or line inputs. 60-10,000 Hz freq. range
POWER REQUIREMENTS: 110V AC, 95 watts
DIMENSIONS: 18 3/8" W x 10 3/16" H x 15 11/16" D
AGC or Manual Audio & Video gain
POWER REQUIREMENTS: 110V AC, 95 watts
WEIGHT: 65 lbs.

MAINTAINANCE
MANUAL **$5.00**

LIST PRICE (1972) **$995.00**

OUR PRICE (NEW) **$450.00**

(USED) **$250.00**

Experimenter's Special **$125.00**

ORDER BLANK

Please rush ________ Bell & Howell model/s 2966________Bell & Howell model/s 2965

_____Rolls, Video Tape_____Batteries_____Color Adapters

Price__________

to: Name________________________________

Shipping________

Address________________________________

Total __________

City_______________State________ZIP________

RECHARGEABLE BATTERIES – New, for Porta Pak . **$36.00** a set.

COLOR ADAPTERS – limited number available, will work in almost any Black and White VTR to convert to NTSC color, record-playback – does not impair monochrome use. **$400.00** ea. prepaid.

NEW NAME BRAND VIDEO TAPES – 2400 ft. (1 hr.) any quantity available, shipping wt. 2 lbs. **$25.00** each.

CONDITIONS OF SALE:

NEW EQUIPMENT – sold new, but as is. Guaranteed 90 days. Replaced or repaired by us, if found defective upon arrival.

USED EQUIPMENT – sold *as is* in good working order. NO warranty. All units checked prior to shipment.

EXPERIMENTER'S DELIGHT – used *as is* repairable. Physically intact not beat to hell, but requiring some work. Problems and probable causes listed with each machine.

PARTS – available at near giveaway prices, through us.

SERVICE – units can be serviced by any competent video technician, as well as through Bell & Howell AV Service and Shibaden in Melrose Park, Illinois.

QUANTITY DISCOUNT – on orders of more than 10 machines.

DEALER INQUIRIES – are invited for sale of new equipment.

New machines have standard Japan EIA 8P connector to mate with all popular VTR monitors. Used machines have all coax and cannon xl connectors. Used machines do not have AGC or edit ability, but are otherwise identical and interchangeable.

All sales are final. Cash with order. Shipped best way. Add $20.00 per VTR and $12.00 per Porta Pak for shipping – excess refunded.

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IS NON-TOXIC
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that will not slip out of your pocket.

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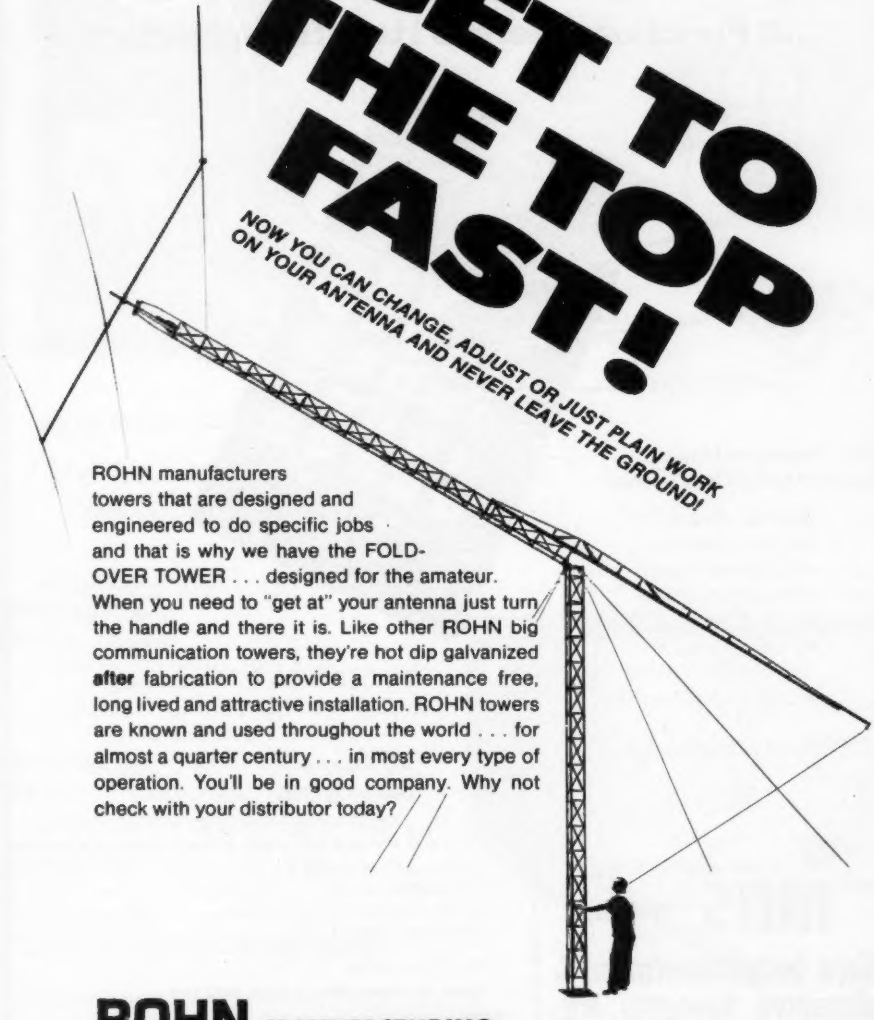
"SPECIAL QUANTITY PRICES ON IMPRINTED ORDERS"

GET TO THE TOP FAST!

NOW YOU CAN CHANGE, ADJUST OR JUST PLAIN WORK ON YOUR ANTENNA AND NEVER LEAVE THE GROUND!



ROHN manufacturers towers that are designed and engineered to do specific jobs and that is why we have the FOLD-OVER TOWER . . . designed for the amateur. When you need to "get at" your antenna just turn the handle and there it is. Like other ROHN big communication towers, they're hot dip galvanized **after** fabrication to provide a maintenance free, long lived and attractive installation. ROHN towers are known and used throughout the world . . . for almost a quarter century . . . in most every type of operation. You'll be in good company. Why not check with your distributor today?

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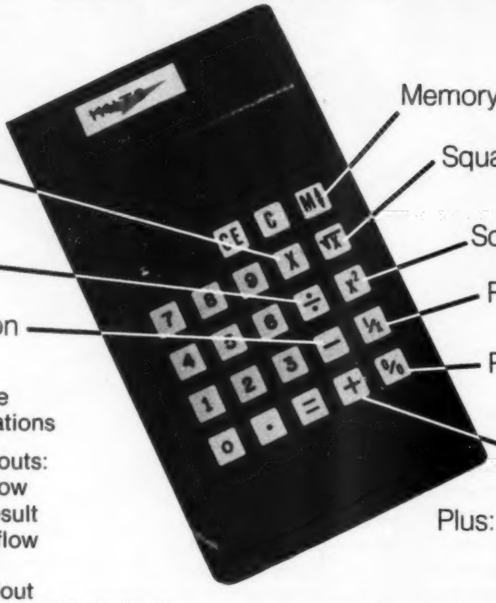
MITS Presents The New 908M Series Handheld Calculator

...8 Functions Mean a Handful of Features!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SIZE: 5-3/4" x 3-1/4" x 1-1/2"

Plus:
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- Algebraic Logic

PRICES*$129.95 Assembled
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Full 1 Year Warranty

AC Adapter for 110VAC Operation $6.95
Carrying Case (leatherette) $5.95

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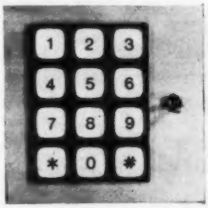
UT–1

Portable Tune Up Meter with cables to plug into Motorola, Link, GE, Standard, etc. This unit gives you the meter functions of the radio being tested. It also operates as a portable dc voltmeter with the following full scale ranges: 1.5, 5, 15, 50, 150, 500, 1 KV with a special 3 volt range for GE Progress Line equipment. The UT-1 can be set zero center for discriminator readings. Also featured in the UT-1 is a field strength meter. Place your order now. Kit form **$42.50**. Wired **$49.95**. Extra cables of your choice (specify rig) . **$5.00 ea.**

($2.00 for postage and handling.)



TESCO–PAD

The "TESCO–PAD" has no tuned coils to go off frequency, no tuning necessary or even there! It's all in one "Black Box I.C." ready to go. The "TESCO–PAD" has a 1 second hold-up for your transmitter, complete P.T.T. operation, available with dual audio output levels, 12 or 16 tone combinations.

KIT $34.95 **$39.95 Wired**

(Add $1.00 for 16 tone version)
($2.00 for dual output version)

Add $1.00 for postage and handling.)

THE ULTIMATE IN 12V POWER SUPPLIES . . . . .

- Tabletop size – 10¼"w by 8"h by 13" long
- 60 A @ slightly less than 12 Vdc
- Nominal Output: 50 A at 12 Vdc
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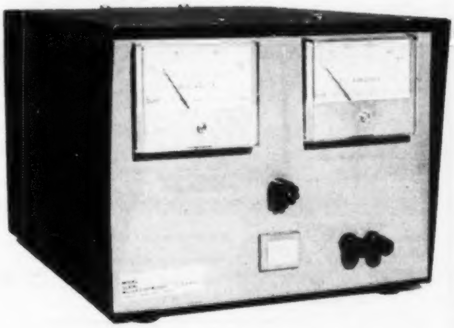
- Will run a mobile rig & even an amplifier from 110 Vac



$100 KIT

$125 WIRED

Shipped freight collect – 47 lbs.

ORDER NOW – PRICE INCREASE COMING IN EARLY 1974

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GTX-2

30 WATTS OUTPUT

2 meter FM Transceiver

(1) GTX-2 (built-in DC PS) and 94/94 .... 240.95
(2) AC REGULATED POWER SUPPLY $49.95
(3) 2 Extra crystals your choice (stock list) $12.00
REGULAR $311.90
OUR SPECIAL PACKAGE PRICE! $249.95

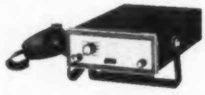
GTX-200

30 WATTS OUTPUT

100 channel combinations; features independent selection of transmit and receive frequencies, and switch for preselected pairing.

(1) GTX-200 (built-in DC PS) & 94/94 ....$259.95
(2) AC REGULATED POWER SUPPLY $40.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGULAR $321.90
OUR SPECIAL PACKAGE PRICE! $259.95

GTX-10



100% AMERICAN MADE

10 watts output

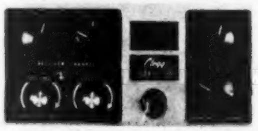
Simple conversion to 30 watts output

(1) GTX-10 (built-in DC PS) & 94/94 ....$199.95
(2) AC REGULATED POWER SUPPLY $34.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGUAR $246.90
OUR SPECIAL PACKAGE PRICE! $199.95

Please add $10.00 Substituting HAMPAK for AC on GTX-10 Package. With HAMPAK & AC $229.00

HAMPAK

Battery pack for GTX-10 portable operation. Uses 10 D cells (not included). (Includes portable antenna, carrying handle & mike clip) $39.95



CLEGG FM-27Bs

(Reg. $479.95), with Clegg AC (Reg. $559) Write for special deal!

Regency, Midland, Gladding 25, SBE, etc., also in stock. Please write for quote

*** FLASH * FLASH * FLASH ***
Look at what you get for NO REPEAT-NO EXTRA CHARGE. The GTX-2 and GTX-200 now have a super-sensitive Dual-Gate Mos Fet pre-amplifier BUILT IN the receiver front end for superb, less than .25 microvolt sensitivity. THE BEST receiver now even better!

30 WATTS OUTPUT. ALL SOLID STATE (no tubes). TRUE FM (not Phase modulation) for superb audio quality.

10 channels in GTX-2 & GTX-10 with 146.94/146.94 included. Three pole low pass filter on both transmit and receive. 1 watt low power position. Provision for tone encoder. Simple internal strapping provision allows multi-channel use of any crystal in GTX-2 and GTX-10. Microphone and mobile mounting bracket supplied. G-10 GLASS BOARDS. Professional level construction by distinguished Avionics Mfg. — General Aviation Electronics, Inc. The finest amateur FM transceiver available at any price. Size: 9 x 6½ x 2½. Weight 5 lbs. Current Drain: Receive: .09 amps, Transmit: High 5.0 amps, Low: 1.7 amps, Made in U.S.A.

	Reg.	Our Price
ALPHA		
Alpha-70 PA-70V vapor cooled linear, brand new cond.	1,275.00	895.00
AMECO		
TX-62 6 & 2 meter xmitter w/621 VFO, Dow Relay	149.00	95.00
TX-62 6 & 2 meter xmitter	99.00	69.00
BIRD		
43 wattmeters (new) limited quantity		95.00
COLLINS		
62S-1 VHF conv.	595.00	495.00
KWM-1 xcvr w/516F-1 AC and 312 B-3 (same as 312B-4, patch, SWR, etc.) latest, new cond.	435.00	395.00
CLEGG		
99-er 6m xcvr working, as is	59.00	29.00
Thor 6 xcvr w/AC mod	169.00	99.00
FM 27A FM xcvr, like new	329.00	299.00
DRAKE		
2B rcvr, 2BQ "Q" mult/spk	210.00	179.00
2A rcvr, 2AQ "Q" mult/spk and cal	189.00	149.00
MN-2000 matching network	159.00	139.00
T4X B w/custom AC/spk by Drake, new cond, in carton	489.00	389.00
SW4A gen. cov. rcvr., new cond.	229.00	199.00
GALAXY		
FM-210 w/AC 210 amp, 6 xtals, mic.	189.00	125.00
GLADDING		
Gladding 25 w/xtals 34/76, 94/94, 64/64, 22/82, 28/88, and 16T	199.00	159.00

	Reg.	Our Price
GONSET		
6m Comm IV	119.00	69.00
HALLICRAFTERS		
SX-111 rcvr latest w/prod. dect.	129.00	99.00
SR-150 xcvr w/AC/spk	350.00	249.00
SX-146 rcvr, R-50 spk, HA-19 cal. (xceives w/HT-46)	195.00	169.00
SR-42A 2m xcvr, new cond, w/2 xtals	149.00	119.00
SR-46A 6m xcvr new cond. w/4 xtals	109.00	89.00
HA-26 6 & 2 VFO	39.00	29.00
HEATH		
HX-10 Marauder 180 watt SSB-AM xmitter	189.00	119.00
HW-16 CW xcvr 80, 40, 15	99.00	79 UC
HG-10 VFO 80-2 meters	39.00	29.00
SB-110A 6m SSB xcvr w/SB-500 2m transverter & HP-23A/AC like new, checked by Heath	439.00	329.00
SB-500 2m transverter	129.00	89.00
HD-1 "Q" mult w/built in AC ps.		10.00
SBA-300-3 6m Conv.		8.00
KNIGHT/ALLIED		
TR-108 15 watt 2m xcvr w/AC, DC, mic, like new	99.00	79.00
AX-190 ham rcvr, 80-10 + WWV, 1 KC cal, etc.	199.00	149.00
MAGNUM		
Magnum 6 RF speech processor for Kenwood T-599, brand new, warranty	139.95	99.00

	Reg.	Our Price
NATIONAL		
NCX-5 conv. to MK-2 w/NCX-A AC/spk, 100Kc cal.	429.00	325.00
NC-155 rcvr	119.00	69.00
NCX-5 MK II w/NCX-A AC/spk, 100Kc cal	450.00	379.00
SWAN		
SW-240 w/117B AC/ps brand new cond.	229.00	179.00
250C 6m xcvr w/117XC AC/spk, VOX, NS-1 noise silencer, new cond.	430.00	389.00
117X basic AC	65.00	39.00
TPL/TEMPO		
502 5-15/35-55 watt output 2m amp, new	105.00	79.00
502B 1-3/45 50 watt output 2m amp, new	130.00	99.00
LW 1500 Dummy load wattmeter, new	119.00	79.00
TC-102 24 hr. Digital clock, new	69.00	59.00
TEST EQUIPMENT		
Eico 378 Lab audio gen., like new	89.00	39.00
Clemmons SB-838 sig. gen. like new	295.00	225.00
RCA WV-98C Senior VTVM, new	99.00	59.00
Heath IOW-102 solid state scope, new	189.00	129.00
Winslow megohm meter (megger)	150.00	69.00
LEADER write for prices		
B & K write for prices		
MIIDA, #6854 4½ digit digital auto-ranging multimeter, new	889.00	579.00
MIIDA #5108 10Hz to 550MHz freq counter, new	950.00	725.00
MIIDA precision calculators	89.00 • UP	

COMING SOON!!!! Genave Touch-Tone Pad, Genave Repeater and MUCH MORE.

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2 oz. copper on glass epoxy base, approx. 5" x 6". Your choice copper on one or both sides.

3 for $1.00

LED READOUTS *"Lowest Prices Ever"*

Similar to MAN-1. .33" high. 20 mA per segment. With decimal point.
Everyone checked – all segments operating **Red – $2.00 each, 6/$10.00**
Larger .7 inch readouts available – write for prices **Green – $3.00**

LED - *molded plastic dome shape with leads.*
.312 inches in diameter **Red – $.25 each, 5 for $1.00**
Green – $.40 each, 5 for $1.85

KODAK RED Wratten Filters

Perfect for light filter over red LEDs. 4" sq, .005" thick.

$.35 each, 3 for $1.00

LM 309 Voltage Regulator IC. *5 volts at 1 Amp. max. current.*

$2.00 each

ETCHANT FOR P.C. BOARDS

Ammonium persulfate, 1 lb. of crystals, just dissolve in H_2O.

$1.00

IN 914 DIODES **10¢ ea/$1.00 Dozen**

TTL ICs

7400	$ .30	7474	.55
7402	.30	7475	.85
7404	.35	7476	.60
7408	.30	7490	1.00
7441	1.75	74121	.60
7447	1.40	74192	1.90
7448	1.65	741 op amp	.55
7473	.55		

Please add shipping charges

MINIMUM MAIL ORDER $2.00

master charge

SEND FOR LATEST FLYER OF SURPLUS AND NEW ELECTRONICS

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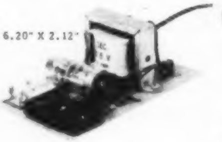
1916 Clark Avenue Cleveland, Ohio 44109

NEW and SURPLUS ELECTRONICS FOR THE HAM and EXPERIMENTER

SIZE:
3.55" X 6.20" X 2.12"



5 VDC 3/4 AMP POWER SUPPLY KIT

12.95

USES THE LATEST STATE-OF-THE-ART THREE TERMINAL REGULATOR CIRCUITRY.

HAS INTERNAL CURRENT LIMIT, THERMAL SHUTDOWN, AND SAFE-AREA COMPENSATION.

Greatest advance in soldering since electricity...

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- COMPLETELY PORTABLE
- HEATS IN 5 SECONDS
- SOLDERS UP TO 150 JOINTS OR MORE PER CHARGE
- RECHARGES AUTOMATICALLY IN ITS OWN STAND
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COMPLETE WITH RECHARGING STAND, FINE TIP AND INSTRUCTION BOOKLET

ALPHA-NUMERIC KEYBOARD

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MICRO SWITCH

MODEL SW-10639 contains 61 #1SW11 Solid-State switches including key tops, ROM encoded into EBCDIC.

MODEL RW-01135 contains 56 #7A1MS Reed switches including key tops, diode encoded into EBCDIC.

"DIP CLIP" IC TEST CLIP

POMONA ELECTRONICS

MODEL 3916

4.95

FOR 14 OR 16 DUAL-IN-LINE PACKAGES

The "Dip-Clip" is specially designed to allow the attachment of test probes to 14 or 16 lead DIPS. The unique design greatly reduces the possibility of accidental shorting while testing live circuits. Numerous test probes may be quickly connected for hands-free testing.

MOS DIGITAL CLOCK CHIP

$ 14.95

Four digit electronic clock LSI circuit in 40 pin DIP. Designed for direct output to Liquid Crystal Display. Internal options include: Alarm, Snooze, Seconds Display, Reset, and 24 hour operation.

CREST POWER STRIPS

WITH: FUSE, SWITCH, AND LAMP

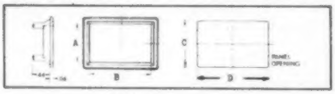
$14.70

$9.30

MODEL 11 Other Models Available MODEL 12

NOBEX DIGIBEZEL

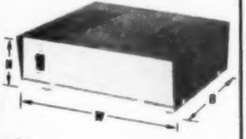
alpha-numeric display bezels



	DIMENSION				PRICE		
MODEL	"A"	"B"	"C"	"D"	1-24	25-99	100-UP
905-XX	.80	1.37	1.172	1.76	$2.25	2.07	1.91
910-XX	.80	2.00	1.172	2.37	2.30	2.12	1.95
915-XX	.80	3.00	1.172	3.37	2.40	2.21	2.04
920-XX	.80	4.00	1.172	4.37	2.45	2.25	2.08
930-XX	1.38	5.00	1.750	5.37	2.75	2.53	2.33
940-XX	.80	5.98	1.172	5.95	2.65	2.43	2.25
950-XX	1.38	6.90	1.750	6.87	3.15	2.89	2.67

WHEN ORDERING REPLACE XX WITH FILTER COLOR CODE:
NEUTRAL = 15, RED = 60, AMBER = 70, GREEN = 90
example: 950-60 (Model 950 with RED Filter)

DOSY BOXS



Deluxe Electronic Equipment Enclosures

MODEL	DIMENSIONS W. H. DEPTH	Screen Vented	RESALE NET
"A"	5¼ × 2½ × 3	no	3.75
"B"	5⅝ × 3⅜ × 3⅝	no	4.95
"C"	7⅛ × 3⅜ × 5	yes	5.95
"D"	8 × 2½ × 8 (mobile mtg. avail.)	yes	5.75
"E"	6⅝ × 3⅝ × 7⅜	yes	8.25
"F"	7⅜ × 4⅛ × 10	yes	9.95
"G"	10⅝ × 3⅛ × 9	yes	9.95
"H"	4⅝ × 6⅝ × 4	no	8.95
"D1"	Mtg. bracket set for "D"		.35
"H1"	"H" Panel with mounted Wide Vue meter, 3⅝" 0-1 ma DC & 2 Rocker switches		19.95
"HA"	5 1/8 × 5 1/2 × 4 (Blank Panel)		6.95
"J"	5 × 3 1/2 × 5 3/4 (Sloping Panel)		7.45
"K"	4 3/4 × 7 3/8 × 11 W/Handle		13.50
"L"	11 1/8 × 6 1/8 × 12 3/4		20.50
"M"	11 1/8 × 6 1/8 × 16 3/4		21.80

OTHER DISTRIBUTOR LINES:

ESSEX
TAB BOOKS
J.W. MILLER Co.
LUMINETICS
Vector Electronic Company
projects unlimited
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EMICO
BUD RADIO, INC.
HUNTER TOOLS
STEWART WARNER MICROCIRCUITS DIVISION
STEWART WARNER CORPORATION

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The New DELUXE DIGITAL SYNTHESIZER from RP

MFA-22 SYNTHESIZER
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A
B
SPLIT
SIMPLEX
REPEAT
MODE
OFF
ON
POWER
TRANSMIT FREQUENCY

RP
TRANSMIT FREQUENCY
SIMPLEX
REPEAT
MODE
OFF
ON
POWER

MFA-22 Dual Version: $275.00*

- SUPER ★ TRANSMIT and RECEIVE OPERATION – SIMPLEX and REPEATER MODES in both versions.
- SUPER ★ READOUT – DIRECT DIGITAL READOUT – fast acting lever switches.
- SUPER ★ LOW SPURIOUS OUTPUT LEVEL – low spurious output is similar to a crystal output, not spurious laden as with some other units.
- SUPER ★ FAST ACTING CIRCUITS – 0.15 second typical settling time.

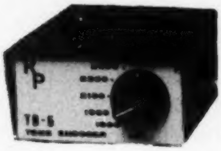
MFA-2 Single Version: $210.00*

- SUPER ★ ACCURATE FREQUENCY CONTROL – .0005% accuracy, both transmit and receive, on all channels.
- SUPER ★ STABLE LOW DRIFT OUTPUT – 20 Hz per degree C typical drift rate.
- SUPER ★ COVERAGE – FULL 2 METER BAND COVERAGE: 144.00 to 147.99 MHz in 10 KHz steps.
- SUPER ★ LOW IMPEDANCE OUTPUTS – 50 ohm output impedance allows long cable runs, both transmit and receive, for trunk or remote units.

SEND FOR FREE DETAILS TODAY **ORDER DIRECT or THROUGH YOUR DEALER**

(*Add $3.00 per unit shipping charge. UPS areas. $5.00 otherwise. ILLINOIS RESIDENTS add 5% Illinois sales tax.)

TONE BURST ENCODERS AND DECODERS



- UP to 5 fixed tones (factory set)
- ADJUSTABLE
  - —Duration
  - —Output
- NO BATTERIES needed.
- FULLY ADAPTABLE
- EASY INSTALLATION
- CONTINUOUS TONE POSSIBLE
- FULL 1 YEAR RP Warranty

PRICES:

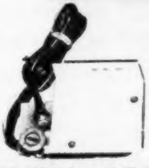
TB-5 5 tone std. encoder **$37.50**
(1800, 1950, 2100, 2250, 2400 Hz.)

ST-2 Single tone decoder **$37.50**
(Specify 1800, 1950, 2100, 2250, or 2400 Hz.)

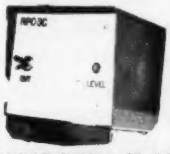
Special tones — Inquire

Add $1.80/unit for shipping
(Ill. residents add 5% tax)

A SPEECH COMPRESSOR THAT REALLY WORKS



RPC-3,3U Internal Unit
($24.95)



RPC-3C Cabinet Model
($34.95)

RPC-3M Module
(ONLY $22.50)

- Low distortion circuit.
- Fully wired & tested. NOT A KIT
- Works with phone patch.
- Internal units & modules work mobile.
- FULL WARRANTY — ONE YEAR
- INTRODUCTORY LOW PRICES
(Illinois residents add 5% Sales Tax)

Add $1.00/unit shipping (RPC-3, 3U, 3M)
Add $2.00/unit shipping (RPC-3C)

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BOX 1201B
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NEW.....

$49.95

Wired and Tested

- 1–2 WATTS IN 15 WATTS PLUS OUT
- SOLID STATE SWITCHING
- 12–14 VOLTS NEGATIVE GROUND
- LESS THAN 1 DB LOSS ON RECEIVE

VHF ENGINEERING
BINGHAMTON, N.Y. 13902
VHF AMPLIFIER
PA-1501H
1004

PA-1501 H

Only 2" x 2½" x 6½"

$39.95 *complete kit*

Also available:

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• **RX-144/220F** 2/220 receiver kit w/ceramic filter	**65.95**
• **RX-144/220C** 2/220 receiver kit w/crystal filter	**69.95**
• **TX-144** 1 watt exciter	**29.95**
• **TX-220** 1 watt exciter	**29.95**
• **PA-144/220** 15 watt amp less cabinet, connectors, and switching	**29.95**
• **PA-144/220** 25 watt amp less cabinet, connectors, and switching	**49.95**
• **PA-8005H** 90 watt amp 5 watts in wired/tested	**159.95**
• **PA-8020H** 90 watt amp 25 watts in wired/tested	**129.95**
• **PA-432** 10 watt amp less cabinet, connectors, and switching	**39.95**
• **PS-12** 12 amp regulated 12-15 volt power supply kit	**59.95**
• **PS-12W** Wired/tested	**69.95**
• **PS-24** 24 amp same as PS-12 less case	**69.95**
• **COR-1** COR with 3 second and 3 minute timers	**19.95**

Write for data sheets on any above units. Add postage. NY state residents add sales tax.

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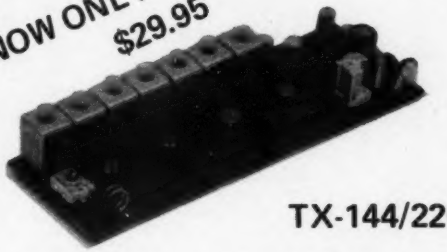
COMPLETE WITH DRILLED BOARD

NOW ONLY $29.95

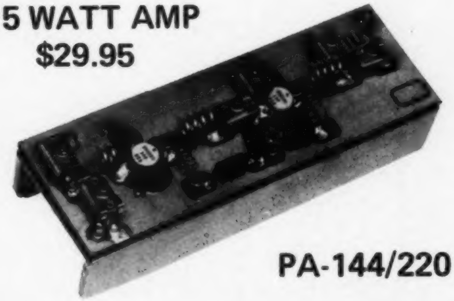


TX-144/220

- TYPICALLY 1 1/2 WATTS OUTPUT AT 12.6 VOLTS (1 WATT ON 220)
- ADJUSTABLE DEVIATIONS TO 10 kHz
- AUDIO CLIPPING AND ACTIVE FILTER
- CRYSTAL NETTING TRIMMER
- DOUBLE TUNED RF STAGES FOR A CLEAN SIGNAL
- STANDARD 12 MHz CRYSTALS (14 MHz FOR 220)
- ZENER REGULATED OSCILLATOR
- PROVISIONS FOR METERING EACH RF STAGE
- PREDRILLED AND TINNED GLASS CIRCUIT BOARDS
- MEASURES ONLY 2" x 6"

A one watt exciter using four RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with our PA 144 or 220 amplifier for a fifteen watt station.

15 WATT AMP
$29.95



PA-144/220

- 15 TO 20 WATTS OUTPUT WITH 1 1/2 TO 2 WATTS DRIVE. (SLIGHTLY LESS ON 220)
- USES TWO BALANCE EMITTER RF POWER TRANSISTORS ABLE TO WITHSTAND A HIGH SWR.
- TYPICALLY DRAWS 3 AMPS FROM A 12 to 14 VOLT NEGATIVE GROUND SUPPLY.
- COMPLETE WITH CIRCUIT BOARD AND ALUMINUM HEAT SINK.
- ADD YOUR OWN MINIBOX AND RELAY AND SAVE.

COMPLETELY PACKAGED PA144/220 AMP JUST $49.95 with solid state switching. 1–2 watts in gets you 15++ watts out. Size 6½X2 5/8X2 with PL-259 in and out.

Order TX-144 or TX-220, $39.95 PA-144 or PA-220, $29.95. Add 1.00 postage and handling for each kit ordered. New York State residents add sales tax.

VHF ENGINEERING
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the tempo line

...a reputation built on quality and value

IN LESS THAN THREE YEARS THE TEMPO LINE HAS ESTABLISHED A SOLID REPUTATION FOR FIRST RATE PERFORMANCE AT A REASONABLE PRICE. WHETHER YOUR INTERESTS LIE IN HIGH FREQUENCY SSB OR VHF/UHF FM, TEMPO DESERVES YOUR SERIOUS CONSIDERATION. YOU WILL NEVER BE SORRY.

THE TEMPO ONE SSB TRANSCEIVER

Look at the specifications . . . look at the price tag . . . ask any of the thousands of Tempo ONE owners about its reliability . . . and the reason for its unparalleled popularity will be obvious. The Tempo ONE is now the proven ONE.

FREQUENCY RANGE: All amateur bands 80 through 10 meters, in five 500 khz, ranges: 3.5-4 mhz., 7-7.5 mhz., 14-14.5 mhz., 21-21.5 mhz., 28.5-29 mhz. (Crystals optionally available for ranges 28-28.5, 29-29.5, 29.5-30 mhz.)
SOLID STATE VFO: Very stable Colpitts circuit with transistor buffer provides linear tuning over the range 5-5.5 mhz. A passband filter at output is tuned to pass the 5-5.5 mhz. range.
RECEIVER OFFSET TUNING (CLARIFIER): Provides ±5 khz. variation of receiver tuning when switched ON.
DIAL CALIBRATION: Vernier scale marked with one kilohertz divisions. Main tuning dial calibrated 0-500 with 50 khz. points.
FREQUENCY STABILITY: Less than 100 cycles after warm-up, and less than 100 cycles for plus or minus 10% line voltage change.
MODES OF OPERATION: SSB upper and lower sideband, CW and AM.
INPUT POWER: 300 watts PEP, 240 watts CW
ANTENNA IMPEDANCE: 50-75 ohms
CARRIER SUPPRESSION: −40 dB or better
SIDEBAND SUPPRESSION: −50 dB at 1000 CPS
THIRD ORDER INTERMODULATION PRODUCTS: -30 dB (PEP)
AF BANDWIDTH: 300-2700 cps
RECEIVER SENSITIVITY: ½ μv input S/N 10 dB
AGC: Fast attack slow decay for SSB and CW.
SELECTIVITY: 2.3 khz. (−6 dB), 4 khz. (−60 dB)
IMAGE REJECTION: More than 50 dB.
AUDIO OUTPUT: 1 watt at 10% distortion.
AUDIO OUTPUT IMPEDANCE: 8 ohms and 600 ohms
POWER SUPPLY: Separate AC or DC required. See AC "ONE" and DC1-A.
TUBES AND SEMICONDUCTORS: 16 tubes, 15 diodes, 7 transistors

TEMPO" "ONE" TRANSCEIVER	$349.00
AC/ONE POWER SUPPLY 117/230 volt 50/60 cycle	$ 99.00
DC/1-A POWER SUPPLY 12 volts DC	$110.00
VF-ONE EXTERNAL VFO	$ 99.00

THE TEMPO 2001 LINEAR AMPLIFIER

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full 2 KW PEP input for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. PRICE: $545.00

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FT-101	Transceiver	649.00
FTdx-401	Transceiver	599.00
FL-2100	Linear Amp with tubes	339.00
YC-355D	Digital Counter	289.00
FV-101	External VFO	99.00
SP-101P	Speaker/patch	59.00
SP-101	Speaker	19.00
FV-401	External VFO	99.00
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SP-401	Speaker	19.00
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FA-9	Fan	19.00
MMB-1	Mobile bracket	9.00

Prices subject to change without notice.

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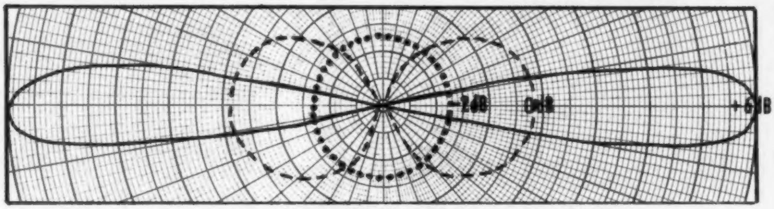
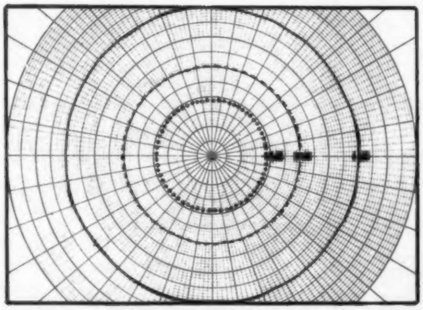
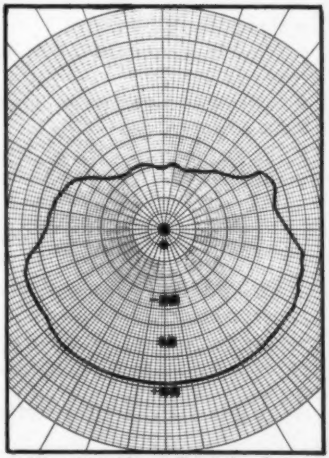
8.2 dB GAIN OVER ISOTROPIC



Vertical Radiation Pattern —— TG5-S
- - - Dipole
• • • • Isotropic



Horizontal Radiation Pattern
—— TG5-S
- - - Dipole
• • • • Isotropic



Offset Side Mount Radiation Pattern
Reference: Dipole

(ON FILE WITH FCC)

MODEL TG5-S

104^{50} LIST PRICE

Weight 3½ lbs.

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$50.00 worth of other equipment FREE when you buy an FPM-300 at $595.

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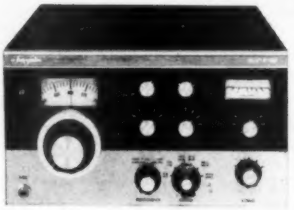

- Crystals supplied for 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 29.0 MHz. Optional xtals may be installed for other 10 meter coverage.
- Plate Power Input: 550 watts PEP on SSB - 360 watts on CW and RTTY (50% duty cycle).
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$595

Power Supply
$99.95

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base unit
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5 LEVEL TELEPRINTER TAPE READER WESTERN UNION MODEL 8C, 5 level tape reader. Magnet tape advance good for high speeds. Excellent for use with Electronic.
Parallel-to-serial converter (Transmitting Dist.) $7.95

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(torroids can be used to build tone decoders) with data sheets.

TS 1060 TELETYPE DISTORTION TEST SET Compact 3" Scope Indicator 110V 60 cy Power 6"x8"x14" $14.95

MISCELLANEOUS

Linemen Belts, complete with safety strap **$9.95**
Pole Climbers, complete with leather pad and straps **$4.95**

Cradle Telephone, with dial **$7.50**
with multiple stations **$9.95**

TA-1, sound power unit, compact hand held. Just hook up wire and use. With built in generator for ringing. No batteries needed **$14.95 a pair**
$7.95 each

SPECIAL – ARC-5 Q'5er **$7.95**

TA-182 – Converter, Telegraph & Telephone signal conv. housed in a waterproof, metal case 12" x 7" x 6". Wt. - about 10 lbs. Complete with 110 V, 60 cy. power supply, (some hams have converted this unit to a teletype converter). With schematic. **Only $4.95**

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OS-SE/5 Oscilloscope This is the "E" model of this series which is a later version, portable 3" scope. Size 6"x8"x14" AC supply, 2 MC wide with carrying case. Wt. 12 lbs. $39.50

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16MM MOVIE CAMERA complete with F 3.5 lens.
magazine load type
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Muffin Fans **$4.95**

24 Volt Power Supply, at 30 Amps. regulated rack mount **$37.50**

Bodine Gear Reduction Motor, 10 rpm, 180:1 ratio. Torque 7.0 inch lbs. .6 Amp cont.duty 115 volts, 60 cy. **$4.95**

Model 15 Teletype RO, Sync motor, good condition **$35.00**

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RT 66 FM transceiver, 20 to 28 MC	**$27.50**
RT 67 FM transceiver, 27 to 39 MC	**39.50**
RT 68 FM Transceiver, 38 to 54 MC	**49.50**
R109 FM Receiver, 27 to 39 MC	**27.50**
GR 758A Wavemeter 55-400 MHz, new	**$9.95**
HP 212A Pulse Gen. (rack mtd.)	**34.95**
HP 524D Counter (main frame)	**229.50**
HP 522B counter 10 Hz to 12 kHz	**107.50**
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HP 624B "X" Band Test Set	**199.50**
HP 686A Sweep Generator	**189.50**
HP 803A VHF Bridge	**79.50**
GR 716C Capacitance Bridge	**127.50**
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STUD 'TRIACS'

PRV	15 amp	25 amp
50	☐ $.65	☐ $.85
100	☐ .85	☐ 1.05
200	☐ 1.25	☐ 1.45
300	☐ 1.45	☐ 1.65
400	☐ 1.65	☐ 1.95
500	☐ 2.55	☐ 2.25
600	—	☐ 2.65

"AEROSPACE" BABCOCK & LEACH CRYSTAL CAN RELAYS

12 for $3.50 ☐

All nermetically sealed. Submini, 1/6, half, and full crystal can types in 6-12-24V in asst contacts up to 4PDT. 1 amp up 10 amps. Such types as BR40, 41, 10, 44, 16, 24, etc. Sorry, no choosing voltages or types. From factory mixtures . . . to you! Good asst, if you are space-minded, at low prices.

SILICON TUBES

- ☐ 5U4 . . . . $1.49
- ☐ 5R4 . . . . 3.95
- ☐ 866 . . . . 7.95

'HAM' UHF 400 MC. HIGH POWER TRANSISTORS

3 for $10. ☐ **$3.95**

By RCA or equal 2N3632. NPN, 23 watts, 3 amps, TO-60 case, with stud mtg. VCEV max 65.

GI "GLASS AMP II" SPACE AGE FEATURE

Type	PIV	Sale
☐ 1N4245	200	$.14
☐ 1N4246	400	.22
☐ 1N4247	600	.39
☐ 1N4248	800	.49
☐ 1N4249	1000	.59

Meets critical JAN specs. A glass "ball of silicon strength" that meets JAN specs, high reliability, withstands avalance power surges to 1K watts. ONE amp ratings with 2 amp capabilities. Axial leads.

☐ **$1.49**

HIGH POWER TRANSISTOR WITH HEAT SINK

3 for $3

Removed from new equipment! Includes popular 2N174 'doorknob' transistor TO-36, germanium, PNP, 150 watts, VCBO 80V, 15 amps, 40 hfe. For ignition, high power transmitters, etc. Mounted on heat sink 5 x 2½ x 1¼".

Buy Any 3— Take 10% Discount!

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Cabinet is compact 6" x 5½" x 6".

CHOOSE YOUR READOUT

Type	LED	Charac.	Sale
KR-101	MAN-3	.12	$47.
KR-102	MAN-1	.27	47.
KR-103	MAN-4	.19	47.
KR-104	Nixie*	.45	47.
KR-105	707†	.33	47.
KR-106	704†	.33	47.
KR-107	SLA-1†	.33	47.
KR-108	Same as SLA-1 but GREEN, add $12.		

† "MAN" LED readouts are "all LEDs" but the Litronix 707 and Opcoa SLA-1, like the MAN-1, are of the reflective bar segment technique, the 704 is the reflective bar version of the MAN-4. *The Nixie tube is a 7-segment device as others.

Scientific Devices introduces the new any LED Kronos digital clock. That's right, you can choose the "ALL-LED" Man-1, Man-3, and Man-4, and the new reflective bar types with the larger digits, at only one price, $47. This is a Scientific Device first! We even hav the GREEN LED readouts at a slightly extra cost. We have more . . . for $19.95 we have available as an (*) extra option to Naval Observatory your clock, or making it an all-purpose all-duty unit. For indoor and outdoor activity. This **"TIME BASE"** is the simplest on the market today with the help of one of the largest time base manufacturers for the famous digital wrist watches. Therefore, current drain is negligible, not like other cumbersome types. It's easy to construct, easy to slip into the Kronos of your choice and connect with easy instructions. Its overall design is simple and easy to construct. The kit is complete with famous black-and-white TEN-TEC cabinet, plus all accessories with booklets. Features include 3 setting controls, 1-hour per second, 1-minute per second, and hold button.

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☐ SN7403	.30
☐ SN7404	.35
☐ SN7405	.32
☐ SN7406	.55
☐ SN7407	.55
☐ SN7408	.35
☐ SN7409	.35
☐ SN7410	.30
☐ SN7411	.35
☐ SN7413	.95
☐ SN7415	.55
☐ SN7416	.55
☐ SN7417	.55
☐ SN7420	.30
☐ SN7421	.35
☐ SN7422	.35
☐ SN7425	.30
☐ SN7426	.37
☐ SN7430	.30
☐ SN7432	.30
☐ SN7437	.60
☐ SN7438	.60
☐ SN7440	.30
☐ SN7441	1.40
☐ SN7442	1.25
☐ SN7443	1.50
☐ SN7444	1.50
☐ SN7445	1.50
☐ SN7446	1.65
☐ SN7447	1.50
☐ SN7448	1.50
☐ SN7450	.35
☐ SN7451	.35
☐ SN7453	.35
☐ SN7454	.50
☐ SN7460	.35
☐ SN7461	.35
☐ SN7462	.35
☐ SN7464	.50
☐ SN7465	.50
☐ SN7470	.45
☐ SN7472	.35
☐ SN7473	.52
☐ SN7474	.52
☐ SN7475	.95
☐ SN7476	.55
☐ SN7477	1.30
☐ SN7478	.95
☐ SN7480	.75
☐ SN7481	1.15
☐ SN7482	.95
☐ SN7483	1.15
☐ SN7485	1.41
☐ SN7486	.55
☐ SN7489	4.25
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☐ SN7491	1.50
☐ SN7492	1.30
☐ SN7493	1.30
☐ SN7494	1.30
☐ SN7495	1.30
☐ SN7496	1.30
☐ SN74104	.55
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☐ SN74106	1.25
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☐ LM-307	Super 741	.59
☐ LM-308	Hi-Q Fet Type Op Amp	1.50
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☐ LM-320	Minus 5V 1-amp V.R.*	1.95
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☐ LM-320	Minus 15V 1-amp V.R.*	1.95
☐ LM-350	Dual peripheral driver	.59
☐ LM-370	AGC squelch op amp	1.49
☐ LM-371	R-F, I-F, op amp	.69
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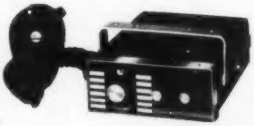

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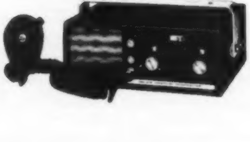

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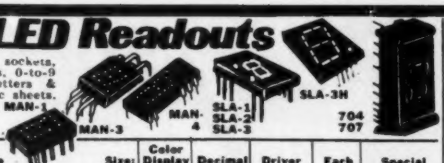
**MAN-1 Specs.
†35-Diode Array.



MONSANTO "ALL LED" Type	Size:	Color Display	Decimal	Driver	Each	Special
☐ MONSANTO MAN-1*	.27	Red	Yes	SN7447	4.50	3 for $12.
☐ MONSANTO MAN-3*	.115	Red	Yes	SN7448	2.25	3 for $6.
☐ MONSANTO MAN-3*	.115	Red	No	SN7448	1.49	3 for $3.
☐ MONSANTO MAN-4*	.190	Red	Yes	SN7448	2.95	3 for $8.
☐ MONSANTO MAN-4*	.190	Red	No	SN7448	1.79	3 for $5.
"REFLECTIVE LITE BAR" (SEGMENT) LED READOUTS! **** Decimal right or left						
☐ LITRONIX 707** (MAN-1)	.33	Red	Yes	SN7447	3.50	3 for $9.
☐ LITRONIX 704*** (MAN-4)	.33	Red	Yes	SN7448	3.50	3 for $9.
☐ OPCOA SLA-1** (MAN-1)	.33	Red	Yes	SN7447	3.50	3 for $9.
☐ OPCOA SLA-3H Giant Digit	.70	Red	Yes	SN7447	8.60	3 for $24.
☐ OPCOA SLA-2 Plus/Minus/1	.33	Red	No	SN7447	3.50	3 for $9.
☐ OPCOA SLA-11C (MAN-5)	.33	Green	****	SN7447	4.95	3 for $13.
☐ OPCOA SLA-12 Plus/Minus/1	.33	Green	—	SN7447	4.95	3 for $12.

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*For Unique Panel Switches

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Mfd. by OAK (Ham's note, RTTY, too) data systems, same as used in Keyboard Calculator, SPST. Normally Open, 24V 1 amp contacts. Characters and letters easily changed. 3/8" high. Printed circuit.

*White top, black numbers.
†Blue top, white characters.

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☐ 1*
☐ 2*
☐ 3*
☐ 4*
☐ 5*
☐ 6*
☐ 7*
☐ 8*
☐ 9*
☐ CE†
☐ CL†
☐ −†
☐ + =†
☐ ÷†
☐ ×†
☐ .*

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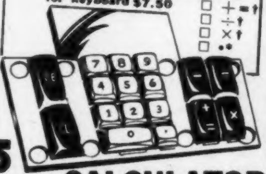

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CALCULATOR KEYBOARD

☐ Etched calculator board with holes, as above, less switches .... $2.50 Board

Properly etched, drilled, "MULTIPLEXED," with proper diodes. Ready to go! Used with our own CAL TECH's 5001 chip advertised at $ 9.95 or equal to Cal Tech or Mostek chip. Keyboard uses the new manufactured by OAK, printed-circuit low-profile FEATHER TOUCH switches. 0-to-9 in white with black letters. Decimal white with black dot. CE, CL and the 4 function switches are in blue with white characters. Designed by top maker. Size: 6½ x 4½ x ½". All etched connections link to take a 12-pin edge connector.

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☐ 1-MV4*, stud, high power, red, 2-watts	3.95
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*Monsanto Equivalent

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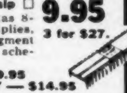
☐ CT5001 Chip ☐ 9.95
3 for $27.

Similar to Mostek 5001. Outperforms Texas 8-digit TMS1802. A 40-pin DIP. Adds, multiplies, subtracts, and divides. Use with 7-segment readouts, Nixies, and LED's. We include schematics, instructions to build calculator.



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☐ CT5005-Same as above with MEMORY — $14.95

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Each board properly multiplexed for 6 digits, to hold MAN-1's, MAN-3's, MAN-4's, Litronics 707 (MAN-1) and 704 (MAN-4), and Opcoa's SLA-1 (MAN-1). Board 6⅞" long with spec sheets. * Elec char. same as Monsanto devices MAN-1 or 4.

Your choice $2.50

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☐ MAN-3
☐ MAN-4
☐ Litronics 707 (MAN-1*)
☐ Litronics 704 (MAN-4*)
☐ Opcoa SLA-1 (MAN-1*)
☐ 6-MAN-3A's for above board. $9.50.

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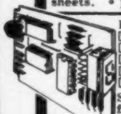
Code: A—Hold Count. C—1 PPS Output.
B—Output Strobe. D—BCD



READOUT	Char.	Maker
☐ MAN-1	.27 h.	Monsanto
☐ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

*Your choice of 5 red LED readouts!

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Scientific Devices "Digital Counting Modules" outperform any other DCM on the market today. More features than ever before! Not gaseous, not incandescents, not nixie but the modern LED. Choose from such famous manufacturers as Monsanto's MAN-1, MAN-4, Litronics 707 and 704, Opcoa's SLA-1 (the last 4 having character heights of 0.33 at no extra charge). Each kit includes 3x2" p.c board with fingers for a FREE edge connector, side-mounting dip socket, LED readout of your choice, resistors, 3 IC's, and Molex connectors (this ELIMINATES SOLDERING YOUR IC's). and booklet. **INCLUDES P.C. EDGE CONNECTOR — FREE!**

* Pin-for-pin MAN-1, ** Pin-for-pin MAN-4, elec. char. same

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Measures only ¾ x 1 x 1¼". Plastic cased. Like KNP type. For pc board or socket, 14 lugs, 1-8/32 stud too! Both 4PDT. All ceramic construction. 3 amps, contacts. For r-f ant, switching. Wt. 1-oz.

Your choice
☐ 115 VAC
☐ 24 VDC

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Type SP332, each digit is individually controlled, operates off 180VDC, 100 ua, 200 mw. Color: ORANGE. 7-digits, glass protection over digits, Character height: 0.33, P.C. mounting. Size: ¾" x ¾". 9-pins per digit. Driver: SN7447.

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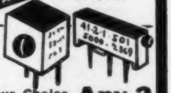

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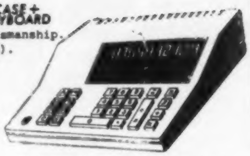
11" wide X 10.5" X 2.9" high

This modular unit is well suited for our calculator chips.Ideal for the CT5005

Case and keyboard complete only $29.95

3 CHIP CALCULATOR

This calculator set provides all of the electronics for an eight digit, floating point calculator with left hand entry. Keyboard, display,clock generator, and display driver is all that need be added to make a calcuthat will add, subtract, multiply, and divide. Overflow and negative signals are also provided. Complete instructions to build a calculator included............................

Chips and data------$7.95
Data only------------1.00
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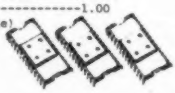

CT5005 CALCULATOR

This calculator chip has a full four function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtract entry from memory), CM (clear memory--without clearing rest of registers), RM (read memory or use as entry).

- 12 digit display and calc.
- fixed decimal at 0,1,2,3,4, or 5
- leading zero suppression
- seven segment multiplexed output
- true credit sign display
- single 28 pin chip

Chip and data-----------------$14.95
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5001 CALCULATOR

40 pin calculator chip will add,subtract, multiply, and divide. 12 digit display and calculate. Chain calculations. True credit balance sign output. Automatic overflow indication. Fixed decimal point at 0, 2, 3, or 4 Leading zero suppression. Complete data supplied with chip.

Chip and data, only $9.95
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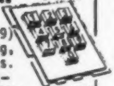

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256x1 BIT Random Access Memory

Fully decoded----TTL Compatible input and output. No clock or refresh required.

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16 pin DIP-full data
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10 for $22.56

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74H00	.50	7454	.35
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7404	.35	74L71	.30
74L04	.50	7472	.50
74H04	.50	74L72	.60
7405	.35	7473	.65
74H05	.50	74L73	.90
74H08	.50	7474	.65
7410	.35	74L74	.90
74L10	.50	74H74	.90
74H11	.60	7476	.70
7413	1.75	74L78	1.00
7420	.35	7480	.65
74L20	.50	7483	1.30
74H20	.50	7486	.80
74H22	.60		
7430	.35		
74L30	.50	7491	1.15
7440	.35	7492	1.15
74H40	.50	7493	1.15
7441	1.60	7495	1.25
7442	1.30	74L95	2.00
7446	1.75	74107	.70
7447	1.75	74121	1.60
7448	1.15	74123	2.00
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7451	.35	74192	2.50
74L51	.80	74193	1.50
74H51	.50	74195	1.10
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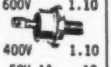
RECTIFIERS

Varo Bridges

VS447	2A	400V	$ .90
VS647	2A	600V	1.10



35A	Stud	400V		1.10
MR810		50V	1A	.10
1N4997		50V	1A	.10
1N4001			1A	.10
1N4002			1A	.11
1N4003			1A	.12
1N4004			1A	.13
1N4007			1A	.17

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IR122	100V	8AMP	.50
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MV-50 red emitting 10-40ma@2V	5 for	$ .25 1.00
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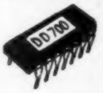
Only $2.25

These were used in the New York Stock Exchange

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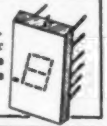
$5.00 each

$4.00 each for 5 or more

MAN1

Seven Segment,0-9 plus letters. Snaps in 14-pin DIP socket or Molex. Operates with IC voltage requirements.Long operating life



$4.25 each

MAN4

Seven segment,0-9 plus letters. Right hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

Each.........$ 3.00
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red lens

'73' SPECIALS

MAN3

0-9 plus letters. Right hand decimal point.Flat-Pack type case.Long operating life. IC voltage requirements. Ideal for pocket calculators !!!!!

Each.........$ 2.50
Ten or more..$20.00

red lens

LINEARS

NE531	op amp TO-5	$2.00
NE560	phase lock loop DIP	3.25
NE561	phase lock loop DIP	3.25
NE565	phase lock loop TO-5	3.25
NE566	function generator TO-5	4.00
NE567	tone decoder TO-5	4.00
NE5556	op amp DIP	1.00
709	popular op amp DIP	.45
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711	dual comparator DIP	.40
723	precision voltage regulator DIP	1.00
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748	op amp TO-5	1.00
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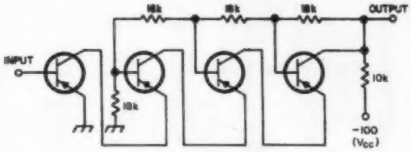
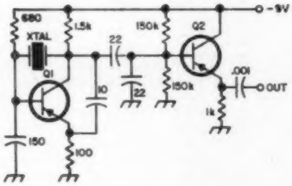


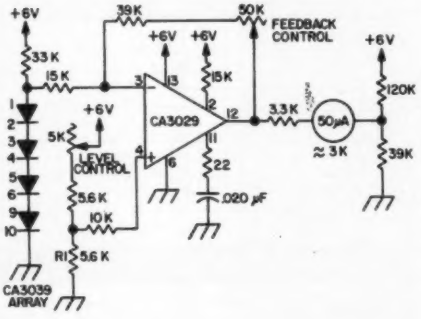
INPUT
18k
18k
18k
18k
OUTPUT
10k
-100
(Vcc)

High voltage direct coupled amplifier. The gain of this amplifier is equivalent to both sections of a 12AU7. All transistors are SK3008, GE-9 or HEP-51.



-9V
680
XTAL
1.5k
22
150k
Q2
Q1
10
22
150k
.001
OUT
1k
150
100

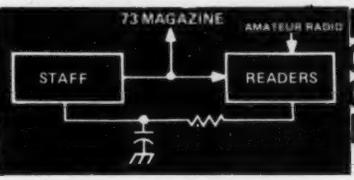
This untuned crystal oscillator will oscillate with any crystal from 300 kHz to 10 MHz. Frequency stability is very good because the emitter follower buffer amplifier effectively isolates the oscillator from the load. Q1 and Q2 are GE-9, SK30006 or HEP-2.



+6V
33 K
15 K
39K
50K
FEEDBACK CONTROL
+6V
+6V
15K
+6V
5K
LEVEL CONTROL
CA3029
3.3K
50μA
≈ 3K
+6V
120K
39K
22
.020 μF
5.6 K
10 K
R1
5.6 K
CA3039 ARRAY
1
2
3
4
5
6
9
10
13
2
12
11
4
6

An electronic thermometer using the CA3039 diode array as the sense element. A CA3029 op amp detects the change in voltage fed into it by the diodes against the level control's reference voltage and displays the amplified difference on the meter. The level control should be set so room temperature reads near mid-scale, while the feedback control adjusts the upper and lower extremes of 120° F and 0° F. From "Handbook of IC Circuit Projects," by Tab Books.

PHASE LOCK



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* ATV Research 43
☐ Autek 71
☐ A & W Elect 152,153
☐ Babylon 158
☐ Bird 56
☐ Bomar 54
☐ Callbook 51
☐ Circuit Spec 127
☐ Clegg 94, 106
☐ Comm Spec 105
☐ Comm Unlimited 138,139
☐ Cornell 104
☐ Dames 120
☐ D A Products 43
☐ Data Eng 137
☐ Datak 56
☐ Densen 118
☐ Dupage FM 121
☐ Dynamic Elect 105
☐ ECM 43
☐ Elect Dist 115
☐ E L Inst 33
☐ Erickson 86
☐ Estes 70
☐ Freck 54
☐ Gam 151
☐ Gateway 67
☐ Genave 91
☐ J J Glass 154
☐ GLB 104
☐ Godbout 119
☐ Goldstein 123
☐ Goodheart 90
☐ Gregory 72
☐ Hal 105,71,122
☐ Ham Radio Ct 92
☐ Hatry 60
☐ Heath 38
☐ Henry 34, 150
☐ Hobby Industry 13
☐ Hygain 124,125
☐ Icom 116,117
☐ Inter Elect 136
☐ Jan 82
☐ Janel 31
☐ Jeff Tronics 145
☐ Jensen 104
☐ Johnson 156
☐ Juge 58
☐ K A Sales 146
☐ K Enterprises 30
☐ KLM Elect 102
☐ Lindy Pen 140
☐ Linear Systems 48
☐ Mann 37
☐ Meshna 132,133
☐ MFJ 105
☐ MITS 110
☐ Motorola 25
☐ M-Tron 104
☐ Newtronics 42
☐ Nurmi 107
☐ Omnibus 52
☐ Palomar 57
☐ Pemco 31
☐ Polygon 95
☐ Poly Paks 155,157
☐ Q-Tronics 43
☐ Regency 41
☐ RGS 126
☐ Rohn 141
* R P Elect 57
☐ Savoy CIII
☐ Sawyer Radio 82
☐ Selectronics 129
☐ Semex 105
☐ Sentry CIV
☐ Signal Systems 127
☐ Solid State 134
☐ S & R 130,131
☐ Stahler 54
☐ Standard Comm 5
☐ Thomas Advertising 52
☐ TPL 44,45,46,47
☐ Tri Tek 96
☐ Unidyne 135
☐ Valpey 112
☐ Vanguard 23,76,97
☐ Van W2DLT 43
☐ Venus Scientific 113
☐ VHF Eng 148,149
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ALASKA	14	7	7	3	3	3	3	7	7	14	14A	14
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JAPAN	14	7B	7B	7	7	7	7	7	7B	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	21	14A	14A	14
PHILIPPINES	14	7B	7B	7B	7B	7	7	7	7	7B	7B	7
PUERTO RICO	7	7	7	7	7	7	14	14A	14A	14A	14	14
SOUTH AFRICA	7	7	7	7	7B	14	21	21A	21A	21	21	14
U. S. S. R.	7	7	3A	3A	7	7B	14	14	14	7B	7B	7
WEST COAST	14	7A	7	7	7	7	7	14	14A	21	21	14A

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ARGENTINA	14	7	7	7	7	7	14	21	21	21	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	7A	7	7	7	7	7	14	21	21A	21	21
ENGLAND	7	7	7	3A	7	7	7B	14	14A	14	7B	7
HAWAII	21	14	7	7	7	7	7	7	14	21	21	21
INDIA	7	7	7B	7B	7B	7B	3B	7A	7A	7	7	7
JAPAN	14	7A	7B	7	7	7	3A	7	7	7	7B	14
MEXICO	14	7	7	7	7	3A	3A	14	14A	14	14	14
PHILIPPINES	14	7A	7B	3B	7B	7	3A	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	14	14A	21	21	21	14
SOUTH AFRICA	14B	7	7	7	7B	7B	14	21	21A	21	21	14
U. S. S. R.	7	7	3A	3A	7	7	7B	14	7A	7B	7B	7

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ARGENTINA	14A	14	7	7	7	7	7	14	21	21	21	21
AUSTRALIA	21	14A	14	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	14	7	7	7	7	7	14	21A	21A	21	21
ENGLAND	7	7	7	3A	7	7	7B	7B	14	14	7B	7B
HAWAII	21A	14A	14	7	7	7	7	7	14	21	21	21A
INDIA	7	14	7B	3B	3B	7B	3B	7	7	7	7	7B
JAPAN	21	14	7B	7	7	7	7	3A	7	7	7	14
MEXICO	14	14	7	7	7	7	7	14	21	21	14A	14
PHILIPPINES	21	14	7B	7B	7B	7	7	3A	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	21	21	21	14A
SOUTH AFRICA	14B	7	7	7	7B	7B	7B	14	21	21	21	14
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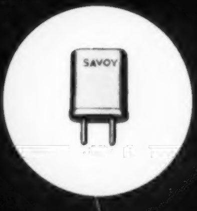

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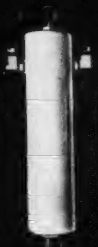

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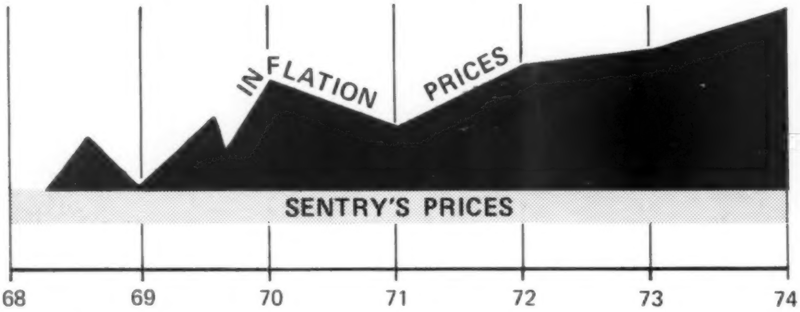

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